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ORIGINAL ARTICLES

PRESIDENT'S ADDRESS*

SOUTHERN SOCIETY OF ORTHODONTISTS

BY W. J. FITZPATRICK, D.D.S., MIAMI, FLORIDA

I WANT, first of all, to express to you my most sincere thanks and appreciation for having selected me as your presiding officer for this, the twelfth annual session of the organization.

I want to thank the Board of Censors and the secretary for their untiring efforts in preparing an excellent program for this meeting.

I wish also to express my appreciation of the work done by Drs. McPhail and Black of this city, for without their efforts we could not have succeeded.

There has been some question raised as to the advisability and legality of a joint meeting with the Ohio State Dental Society at this time; if, however, those raising the issue had read Section 2 of Article 9 of the constitution, there would unquestionably have been no criticism.

I think the Society very fortunate in deciding on the present arrangements because of the very high class program which is made possible thereby, and which would have been financially beyond the reach of our organization functioning alone.

What, but educational, is the reason for any dental or orthodontic gathering? Granted there is no other excuse, why then should not a joint meeting with one of the outstanding state dental societies be of far more benefit than if either should meet alone? I believe much good not only to the members of both societies, but also to the laity, will come of this meeting.

It has been suggested that the selection of the time and place of meeting be left to the Executive Council, but I question the wisdom of such a move.

*Presented at a meeting of the Southern Society of Orthodontists, Cincinnati, Ohio, December 1-3, 1931.

This is, or should be, a democratic organization, and it is my opinion that each member who is interested enough in the work to attend the sessions should have a voice in the handling of its affairs.

I may be criticized for the following remarks, but there must be more convincing evidence than I have had so far before my views are changed. At any rate I want to get this off my mind.

We frequently hear some one say that to make a success of orthodontia it is necessary for the graduate dentist to spend one or more years in some school of training and that it is impossible to render good service with the knowledge gained in any of the short term schools.

Orthodontia being a very young specialty of dentistry, and there having been very little dependable literature on the subject prior to its launching as such, where did the men who do most of this preaching get their knowledge? I agree that one should have all the teaching one can get, but when all is said, the most one gets from any school is the knowledge of how to search and study.

It is my contention that the dentist of today, with his better training and education, which few of the pioneers in orthodontia could possibly have had, and with all the facilities, literature, clinics and society gatherings at his command, if he be vitally interested in the subject of orthodontia and will apply himself diligently, has a far better opportunity of success, after his so-called short term course, than have the men who are agitating this question.

The great need for orthodontic treatment and the inadequate supply of orthodontists call for earnest consideration of this subject. After all, the personal equation is the determining factor between success and failure in any endeavor.

There is one more problem I wish to present to you, and one which I had hoped would never enter into this specialty; I refer to the question of criticism, i.e., criticism of the work of a fellow practitioner. Can you think of anything more despicable than one man making unprofessional remarks to a patient or parent, about another man's appliances or about work that is found in the patient's mouth?

I should be glad to have such a one spend the months of January and February in my office when he would most likely see samples of every conceivable type and kind of appliance. Many of these are extremely crude, and frequently it is very difficult to determine what functions they were intended to perform. Probably, the man who put them in knows, and can accomplish proper results with them where I cannot; at any rate he should have the benefit of the doubt. I long ago learned to be charitable on this subject; otherwise I fear there would be many scores to settle when the patients return home.

ORTHODONTIC EDUCATION*

By Earl G. Jones, D.D.S., Columbus, Ohio

THE subject of orthodontic education has been a debatable question among dental educators and the leaders of our specialized field for years. Never before, however, has the interest been so acute as it is at present, not perhaps from the standpoint of the teacher but from the standpoint of the student or dental practitioner who has suddenly awakened to a realization that orthodontia has outgrown its swaddling clothes and has taken its place with the leading phases of dental practice. Within the last five years, I note a decided change in the attitude of the general practitioner toward the value of orthodontic procedure. In papers dealing with every phase of dental specialization we hear continual reference made to orthodontia. The climax came, I think, last winter at the Chicago clinics when it was generally stated that "orthodontia stole the meeting." Those who were present know of the interest shown by the men in general practice to papers and discussions pertaining to our subject. In fact the room could not accommodate those wishing to avail themselves of the opportunity of hearing the program.

Here then sounds the call that we quit our quibbling and unite upon some plan of definite curriculum for undergraduate work. I feel that a criticism (if you please) should go out to our profession for its indifference to matters pertaining to orthodontic education. Extensive research is made and reports are read, only to find an audience of the faithful few who are already of the same opinion as the author of the report. It is not enough to feel that we have gained our knowledge, now let the other fellow gain his as best as he can. We bewail the fact that dental laboratories are making orthodontic appliances which are being inflicted upon the unsuspecting public; yet what are we doing to help that man who feels he is interested in the practice of orthodontia?

Our dental schools are now going through a period of transition, as to what shall be the length of a dental course and what shall be the curriculum. It seems quite possible to believe that if the leaders of orthodontia could formulate a schedule of study for undergraduate work it might be embodied in the courses which are now in the making. It is quite interesting to note that most of the initiative in many of the colleges has been a result of inquiry and speculation on the part of the deans themselves rather than of those of us who should be more actively interested. It is only natural, however, that they should feel a reticence about formulating a program of study which the orthodontists themselves are not agreed upon.

The problems at present in dental education, however, are many. For those of you who have been out of touch with dental education permit me to review a few changes of the last four or five years.

*Paper presented at a meeting of the Southern Society of Orthodontists, Cincinnati, Ohio, December 1-3, 1931.

Schools offering courses of three years' dental education based upon a prerequisite of a high school diploma or its equivalent, such as many of you, and I, were graduated from, have changed their courses to three plans of study. First, there are the schools (21 in number) which are based on one year predental and four years' dental education. Second, the 2-3 plan in which there are two years' predental and three years' dental training. There are five of these schools. Usually the second predental year under this plan embodies several subjects related closely to the dental curriculum, which may be found in the first year of the dental course of the 1-4 plan; and third, the plan of two years of predental education (following very closely the first two years' schedule of the arts college) and four years' dental education. At present there are sixteen colleges in the United States and Canada on this basis. You who are active in dental education are cognizant of the committee on "The Survey of Dental Curriculae of the American Association of Dental Schools," under the support of the Carnegie corporation, which commenced its study in the summer of 1930. This group has undertaken an extensive two years' study of dental education which may lengthen out to five years before the research is completed. Their study and recommendations are bound to change materially the schedules and the term of the courses of many of our schools.

In my association at Ohio State University (which has comprised fifteen years of teaching), I have had the opportunity of seeing the standards of dental education progress from a course of three years to four years in dentistry, then to one year predental and four years' dental, and finally three years ago this fall it was changed to two years' predental and four years of dental education. There is not a shadow of a doubt but that each progression has brought forth a better educated, finer type of dentist. It has resulted in the profession of dentistry's having the same respect, consideration, and high type of students as are found in the professions of law and medicine.

I hear the accusation of dental autocracy, what is to become of the poor boy who wishes to study dentistry? Are we considering the public and its ability to meet the fees of this high type dentist of six years' training? One of the hardest things for the man to do who has graduated twelve years ago or more is to appreciate that dental education has progressed. He regards the curriculum as about the same as when he was in school. The dentist himself, however, through his reading and contact at dental meetings has progressed, especially in the mechanics of dentistry. The young man of today, therefore, can hardly be expected to gain this additional education necessary to cope with present-day demands unless he has availed himself of additional time and study. As for the poor boy, a comparison of the enrollment this fall at our school with that of twenty years ago shows the students to be coming from families of the same rank and file, namely, farmers, mechanics, laborers, and families where death or poverty has made it necessary for the boy himself to work his way through school. We find the same classification and about the same ratio as twenty years ago. I asked my senior class, "How many are more or less dependent upon yourselves for the financing of your dental education?" and more than half the hands in the class were raised. The age of the graduate today is less than that of twenty years ago in spite of the six-year course. It is

no greater sacrifice for a student of today to gain an education than it was for us of a few years ago.

Now as to the cost of dentistry or orthodontia to the public. Increased time and education have not been the factors to cause increased fees. Dental fees have increased in the same proportion as have other commodities. Present-day economics will always be the factor to determine fees rather than the time and expense of obtaining an education.

The attitude of the student of today is entirely different from that of a few years ago. A man who has had two years of predental education has acquired methods of study, and by the time he has reached his junior year assumes somewhat the attitude of a postgraduate student who can approach a problem as would a research man. The student no longer picks out the soft spots to "get by" but seeks out the professor who can give him the most enlightenment on the subject at hand.

Not that I am trying to establish a certain curriculum (however important I think this should be at this time) but as a basis for discussion, I should like to offer a course of study in dentistry. Based on two years' predental and four years' dentistry it might be as follows:

In the two predental years the student must complete:

Five hours in general zoology,

Five hours in comparative anatomy,

Twenty-five hours in inorganic and organic chemistry, including qualitative and quantitative analysis,

Ten hours of English,

Ten hours of physics,

Five hours of principles of physiology,

Twenty-five hours of electives.

A student may elect subjects in psychology, fine arts, economics, sociology, political science, history or he may select an advanced course in any of the prescribed groups. These courses are offered to premedical and predental students alike.

Four years of dentistry as follows, based on three quarters per year:

First year,		
Prosthetic technic	4 credit hours	3 quarters
Human anatomy	7 credit hours	2 quarters
Dental anatomy	7 credit hours	per year
Technical or engineering drawing	2 credit hours	1 quarter
Histology and embryology	5 credit hours	1 quarter
Physiologic and biologic chemistry	8 credit hours	2 quarters
Second year,		
Operative dentistry (technic)	6 credit hours	2 quarters
Physiology	6 credit hours	2 quarters
(diagnosis)	2 credit hours	1 quarter
Prosthetic technic	3 credit hours	1 quarter
Crown and bridge (technic and principles)	3 credit hours	3 quarters
Bacteriology	5 credit hours	2 quarters
Dental metallurgy	2 credit hours	1 quarter
Dental hygiene and immunology	1 credit hour	1 quarter

THIRD YEAR,

Oral hygiene	3 credit hours	2 quarters
Dental medicine	1 credit hour	2 quarters
	2 credit hours	1 quarter
Operative dentistry (principles and practice)	3 credit hours	3 quarters
Exodontia and x-ray	2 credit hours	3 quarters
General pathology	3 credit hours	2 quarters
Prosthesis (principles and practice)	2 credit hours	3 quarters
Dental pathology	3 credit hours	1 quarter
Crown and bridge (principles and practice)	2 credit hours	3 quarters
Orthodontia (technic and principles)	2 credit hours	3 quarters
Porcelain technic	1 credit hour	1 quarter
Microscopic study of histopathologic structure of teeth	3 credit hours	1 quarter

FOURTH YEAR,

Anesthesia	2 credit hours	3 quarters
(Ethics, economics, history and jurisprudence)	1 credit hour	1 quarter
Dental medicine	2 credit hours	3 quarters
Oral surgery	2 credit hours	3 quarters
Orthodontia (principles and practice)	2 credit hours	3 quarters
Prosthetic dentistry (principles and practice)	2 credit hours	3 quarters
Nutrition	2 credit hours	1 quarter
Operative dentistry (principles and practice)	4 credit hours	3 quarters

This totals 1350 clock hours per year in the first two years, and 1400 clock hours per year in last two years. Total available clock hours per year average is 1408.

I think you will agree that this is a strong course. A course that fully occupies the complete time and attention of a student for six years. A student may reduce his total length of time or lighten his course, thereby gaining more time for outside work by attending school through the summer quarter. I do not recommend this, but it is nevertheless a possibility.

With this amount of study and preparation a student may enter any specialized subject much the same as a Bachelor of Arts graduate enters work for a master's degree. Likewise, the graduate medical student who enters upon postgraduate work has a keener insight because of his premedical and medical training. We should all voice a protest against any specialized phase of medicine curtailing any part of the fundamental study.

Orthodontia in its relation to dentistry bears even a closer association than do some of the specialized fields of medicine to general medicine.

Orthodontia is the one and only subject which puts in a tangible form for practical utility, all the subject matter presented usually in the first two or three years of the undergraduate work. It helps to create the concept of the normal which is the basis of all diagnosis in all phases of dentistry. Orthodontia directs attention to normal processes of development and to normal functional activities of the teeth and surrounding tissues. The orthodontist then must be familiar with all the subjects of dentistry. I cannot see how orthodontia can attain this high standard of perfection by divorcing any phase of the undergraduate curriculum. Short cuts will never attain the ultimate goal which the mature orthodontist of tomorrow will find necessary for his success.

You will note I have placed the orthodontia instruction in the junior and senior years. I am not in favor of completing any phase of specialized training in undergraduate study. I am definitely in favor, however, of giving a student a sufficiently strong course to enable him to appreciate at least some of the minor problems of orthodontic practice. Training carried through the junior and senior years based upon the fundamental biologic sciences as taught by teachers qualified in those branches can be made strong enough to give a student a good conception of the basic principles of orthodontia. A constructive criticism might be that we teachers of orthodontics do not appreciate that in this enlarged plan of dental education the subjects of biology have been amply taught; the biologic sciences of orthodontia are the biologic sciences of dentistry. It is a waste of time to review these courses except to show their relation to orthodontics, and part of this can be done by the teachers of the various sciences if their attention is directed to the application of their subject to our specialization.

As for technic, a much stronger course can be formulated.

A casual survey of the Technic Report published in March, 1931, by the American Association of Dental Schools, compiled by the committee on the survey of Dental Technic, shows some interesting data.

Number schools catalogued	33
Number schools reporting orthodontic technic	20
Number schools failing to report	13
Average hours of 20 schools	64
Average school year in weeks	32

This then is two hours per week for one year. The average amount of technic required consists of three main phases of technic, viz., first, carved plaster models; second, making of McGill bands and alignment appliance; third, making either a lingual appliance or a retainer.

This then figures approximately ten weeks for each requirement.

I should like to read the requirements of the schools.

School No. 1

Junior Year: Hours 128

1. Plaster blocks to specified measurements.
2. Compound impressions: poured in stone and plaster.
3. Plaster impressions.
4. Carving maxillary and mandibular casts in plaster.
5. Technic cast in stone: molar bands; labial appliances; soldering technic.

School No. 2

Third Year: Hours 32

1. Impressions and full maxillary and mandibular models, correctly trimmed.
2. Impressions and models for molar band technic.
3. Construction of two molar bands, fitted to model, with buccal and lingual tubes attached.

4. Construction of lingual arch with auxiliary springs and lock springs attached.

5. Construction of labial arch with stop spring soldered.

6. Construction of two pinched bands with soldered attachments. All soldering to be done with hard solder.

School No. 3

Third Year: Hours 33

1. One set of models of fellow students, taken in compound and trimmed according to Angle and Dewey.

2. Soldering short pieces of wire to main wire, half inch apart, one at a time, without destroying unions already made.

3. One regulating appliance made on metal model of the mouth of a fellow student, consisting of bands with attachments cemented on the teeth of the model, with lingual and labial arch wires contoured to fit.

4. One Angle or Gilmore splint, using models of mouth of fellow student.

5. Swaged vulcanite splint, using models of mouth of fellow student.

6. Splints showing emergency wiring.

The survey shows conclusively that ample time is given but is wasted upon nonessential bits of technic. Plaster models such as are required in most college technic can be included in the plaster work during the freshman year and McGill bands are but phases of crown and bridge soldering.

Allow me to digress for a moment to call your attention to the various opinions of dental orthodontic educators in some of our leading schools. Time is such a factor in the University of California (a college on the 1-4 plan) that I understand a course is being formulated to curtail some of the technic of plate work and crown and bridge, to supplement orthodontic technic principles and practice. To quote Dean Guy S. Millberry, dean of the College of Dentistry, University of California, in a paper read before the American Society of Orthodontists in Estes Park, Colorado, 1929. "My convictions are that neither of these latter subjects (crown and bridge and plate denture prosthesis), are essential to the training of an orthodontist. . . . . I believe that the problem of replacement in dental service is as far removed from orthodontic service as anything can possibly be in the treatment of lesions or conditions of the oral cavity. If any part of the science of prosthesis is necessary in orthodontic education, there is enough free time available in this curriculum to provide for its introduction. . . . .

"Students who contemplate the study of orthodontics can under this plan elect this course; others may choose the course in general dentistry. The only difference between the status of these two groups of students will be that one group pursues orthodontic study, technically and clinically, while the other group pursues the study of crown and bridge and plate denture prosthesis during practically the same number of hours. . . . .

"On completion of the course, the degree of Doctor of Dental Surgery can be offered, and the students will present themselves for examination before the State Board of Dental Examiners, indicating at that time whether they

desire a license as an Orthodontist or as a Dentist. Their credentials will determine their status."

This is but a modified plan of the Arizona Law, which provides for a course in orthodontia separate from that of dentistry and for individual State Board examination. The American Society of Orthodontists voted disfavor upon this law and this type of orthodontic education.

I beg of you to consider your status among your fellow dental practitioners if you were not in every way qualified as are they in all phases of dental practice. I wonder also how many of you men decided definitely in your college days that you were going to specialize in orthodontia; very few, I imagine. Students today are just as undecided. What would become of the man under the California plan who has curtailed his dental course for orthodontia and then finds he is better fitted for some other phase of dentistry.

I like the discussion of Dean Marcus L. Ward of Michigan on Dr. Millberry's plan. He said in part: "My experiences up to this time cause me to state emphatically that until we find that nothing else will work, a specialist should first be a dentist. Not only that, but he should be a good dentist with much more information on the subject in which he specializes than the average practitioner has. . . . . It would seem to me that the public has a right to expect a person, who professes to be a specialist, to be all that a dentist is and much more. . . . . Your very useful and important specialty has developed entirely too far on the basis of a man being first a dentist, to take the retrograde step that would be taken were we to attempt to furnish orthodontists who were not qualified to practice dentistry."

Real progress in dentistry and orthodontia lies not so much in cultivating mechanical dexterity (although exceedingly important) as in the attainment of a broadening education and a mastery of the biologic principles that pertain to function, nutrition and metabolism. General mechanical dexterity can be developed as well in one phase of dentistry as in another. Orthodontic technic is easily accomplished by a student previously skilled in prosthetic and crown and bridge work. Often one's own laboratory technician excels in his ability to construct a certain piece of appliance, yet no one would place any confidence in his ability as an orthodontist. The point I wish to emphasize is that after curtailing technic of other phases of dentistry supplementing orthodontic technic has very little value in the undergraduate curriculum. We are simply sacrificing the structural framework upon which our specialization is built.

At Columbia University there is an entirely different viewpoint. Time does not seem to be a factor. The problem is, shall dentistry continue as a separate science or shall medicine adopt it as a specialized branch? Quoting Dean Alfred Owre, Columbia University: "The Dilemma facing dentistry seems to be this: Shall it remain a completely independent and autonomous profession, like optometry and chiropody, or even like law, engineering and theology, building for itself the foundation, which is now recognized as indispensable, directly from such basic sciences as anatomy, physiology, histology, bacteriology, etc.; or shall it become (as oral surgery) a recognized specialty in medicine."

Dean Winternitz of Yale University Medical School says, "We have lived nearly a hundred years in the most perfect example of an absurd condition that could possibly be conceived of, namely, that dentistry should be an entity separated from medicine. It is inconceivable."

If time permitted, I might read other opinions of both medical and dental educators showing the trend of thought toward adoption of dentistry by medicine. This would mean also adoption of orthodontia. The American Society of Orthodontists has gone on record as absolutely disfavoring such a move.

Dentistry, through its own efforts mainly, has progressed to a science equal in its predental requirements, in its fundamental biologic sciences, and therefore in the quality and fitness of its students, to the college of medicine. Why should it then become a stepchild of medicine, be restricted possibly in its further growth and developments, and become the mechanical aspect of the medical profession? I am in favor of advancement and I feel that dentistry has a greater opportunity, can see its own needs more clearly and administer unto them as a parent-organization than it can by accepting equal allowances with the other specialized fields of medicine. Orthodontia, the infant prodigy of dentistry, would, I fear, have a more difficult time in gaining an educational foothold than it is now experiencing.

As previously stated, I am not in favor of completing any specialized course in the undergraduate years. The specialist in orthodontics must receive his advanced education much the same as the medical surgeon. Strong courses in the fundamental biologic sciences plus theoretic study and clinic observation, are the prerequisites for postgraduate surgery. The same should apply to orthodontia. I should not discredit for one moment the several short term postgraduate courses. Six weeks of concentrated study of eight hours per day affords forty-eight hours per week. Six weeks totals two hundred and eighty-eight hours for the course. This is equivalent to three hours per week for three school years of thirty-two weeks. This is ample time for theoretic and technical study; the greatest criticism is that insufficient time elapses to demonstrate the problems involved in the correction of malocclusion and facial deformity. Just as dentistry has progressed from private schools to integral parts of universities, so will these courses become postgraduate work of the graduate schools of our universities in the near future. This is now being accomplished in several universities where one- and two-year postgraduate courses are being offered. I strongly recommend this; though it is impossible sometimes for a man to give up his practice to avail himself of prolonged study. It seems entirely possible that were this plan universally adopted a man might give certain days each week to advanced education and clinical practice without giving up his general practice entirely. Modern modes of travel should facilitate this nicely.

I hope that I have made myself clear and that these suggestions may be of some value in creating an interest among the profession to insist that:

First, orthodontic education may be standardized.

Second, that orthodontic education may continue to advance, realizing that without a complete course in dentistry as a foundation the specialization of orthodontia would retrogress.

Third, that dentistry can best serve its purpose by remaining the parent-organization.

Fourth, that by realizing that a little education is worse than no education at all, a strong course in the undergraduate school should be formulated to be followed by at least one year postgraduate study.

In closing, I should like to quote the closing paragraph of Dr. A. LeRoy Johnson's lecture before the conference of orthodontic teachers in Philadelphia, 1923.

"Harvey Cushing in his presidential address before the American College of Surgeons in Boston October 27, 1922, chose as his theme the following quotation from La Franc. 'No one can be a good physician who has no idea of surgical operations, and a surgeon is nothing if ignorant of medicine.'" Paraphrased in terms of this paper La Franc's idea would read: "No one can be a good dentist who has no idea of orthodontia and an orthodontist is nothing if ignorant of dentistry."

DISCUSSION

Dr. Harvey G. Bean, Toronto, Canada.—This is a subject which must be of interest to all orthodontists. I agree so thoroughly with the views expressed that I am on this occasion a "yes man." To me it is clear that we must take the lead in teaching orthodontics, or else we must be willing to stand aside and allow the general practitioner to do orthodontia as best he can, for do it he will.

Dr. Jones has said that there has been a marked change in the attitude of the general practitioner toward orthodontics during the last few years.

Specialists too are increasing rapidly in number. Where are these recruits to the ranks of orthodontia obtaining the necessary skill to enable them properly to understand and correct the arch deformities which they see? Certainly not in any undergraduate courses, as far as I am aware.

From private offices and private courses we are today receiving the vast majority of our specialists, and the orthodontically inclined general practitioner is obtaining his knowledge in a much more sketchy way.

Is this a healthy state of affairs when we consider the enormous amount of knowledge necessary properly to discharge the responsibility to the patients? What man, here, of more than ten years' or even five years' experience, feels that he knows half what he would like to know of our specialty? No one, I venture.

The problem is not merely that of passing along present data to newcomers, but orthodontic knowledge must be increased.

The beneficent sunshine of new orthodontic knowledge must clear away the present fog of uncertainty into which most of us are cast when dealing with some cases.

To my mind those who will best clear away our fog banks will be men working in well-equipped schools of graduate studies where they are taught to think as well as to listen and where material, equipment, time and finances are available.

Dr. Noyes, I believe, is "hitting the nail on the head" at his school.

To sum up, I should say that the ideal way for us to advance is:

1. To keep dentistry on its own feet as a separate profession.

2. To maintain a high standard of dental training, with every graduate a fully qualified dentist with a basic knowledge of orthodontia.

3. To develop more postgraduate schools in orthodontia in connection with recognized dental schools.

4. To have more fellowships for research in orthodontics.

As a trend of the times may I point out that at the Second International Orthodontic Congress in London last summer there were two papers, one demonstration, and five exhibits on teaching.

SOME PROBLEMS RELATED TO ORTHODONTIC TREATMENT*

By Frank M. Casto, D.D.S., M.D., Ph.G., Cleveland, Ohio

SINCE the first time an appliance of the simplest design was constructed and used in the mouth for the purpose of moving malposed teeth, the problems related to treatment have occupied a most significant place in the practice of orthodontia.

It is quite true that irregular or malposed teeth were recognized many years before adequate means for correction had been devised, and the development of appliances far preceded a study or understanding of the biologic phase. It was not until about the beginning of the twentieth century that any considerable thought, except the designing and construction of appliances, was given to the problems of treatment. The primary object had been to move irregularly arranged teeth into positions of better alignment, with the hope that they would remain in their new positions and that the facial appearance of the patient would be improved.

The importance and the necessity of establishing correct occlusal relationships were little understood, or else neglected, while the basic principles underlying the fundamental demands of a living organism were almost completely ignored. It would not, however, be just to criticize or decry the practice prevalent in those early days, because knowledge as related to the various phases of orthodontic treatment was vague and limited, and that which did exist was in a chaotic state. It had not been organized or classified so that its general use was available. There was little cooperation or concentration of thought between the men working in the field, and their efforts were along such divergent lines that the problems with which treatment was then and probably always will be confronted was most difficult of comprehension.

As the demand for more and better orthodontic service became manifest, the necessity for the establishment of correct occlusal relationship evident, and the basic principles involved in the care and treatment of patients necessary, a larger group became interested and began a more thorough and more coordinated study with regard to the various problems concerned in the practice of orthodontia. This innovation ushered in a new era—an era of enlightenment and progress. As a result many of the mysteries of practice are being solved, and it cannot be gainsaid in the light of present knowledge that orthodontia has not been established as a distinct specialty.

We now recognize the fact that instead of dealing with an inert and nonresponsive body, a delicate, intricate, and complex living organism is encountered. An organism which during its development and growth is constantly changing and is subjected to various kinds of environmental conditions, some favorable to an expression of the inherent qualities of the cell, and some detrimental. The fact is also recognized that the special parts with which the orthodontist is im-

*Read before a joint meeting of the Ohio State Dental Society and Southern Society of Orthodontists, in Cincinnati, Ohio, Wednesday, December 2, 1931.

mediately concerned cannot be separated from the whole organism. An intelligent service can only be rendered by being familiar with the biologic factors as they may affect the individual. This phase has opened up a new field of study, and the future achievements in orthodontia will depend to a major degree upon the solution of the problems encompassed in this domain.

Investigations have been inaugurated in the last decade which promise much and may in time, if carried on under a proper plan of organization and correlation, place orthodontia on a real scientific basis. Inquiry is being made in regard to the effect of diet upon the teeth and their supporting structures, the physiologic and pathologic processes incident and subsequent to tooth movement, functional disturbances and reactions, the influence of the endocrines upon development and growth, and more study is being given to the hereditary and environmental influences upon malocclusions.

Investigations whereby it is hoped that methods will be developed to determine the periods in a child's life when development and growth are most active in the various parts of the body are being carried on. Such information as is related to the jaws and teeth will be particularly valuable to the orthodontist, since it will serve as an index to indicate the most favorable time to begin treatment and the time when periods of activity and periods of rest should be observed during treatment.

Clinical observation is being made and data are being recorded in regard to the reactions which occur in the application of force in moving the teeth. Several methods have been devised for charting the relation of one dental arch to the other and for predetermining the distance that malposed teeth should be moved. There is a more thorough understanding of the occlusion of the teeth and a better comprehension of the forces that are operative in establishing and maintaining occlusion during development, and which are significant factors in retaining the teeth after they have been moved into correct positions. Metallurgical investigations are being carried on to determine the most useful and efficient combinations of metals for the construction of appliances. Appliances have been refined, the technic has been simplified and the basic principles of construction and application are better understood. The x-ray examination has been developed to the point where its use is indispensible in diagnosis and in making observations during and after treatment.

From a casual survey of the things which have been accomplished and those which are being done, it is quite evident that the responsibilities of the orthodontist have rapidly increased, and he would be negligent indeed if he failed to utilize the information at his disposal.

The first problem related to treatment is to make a careful and painstaking diagnosis, and every available means at our command should be employed in doing so.

The following statement is made by McCoy in his book "Applied Orthodontia": "The diagnosis of malocclusion implies first, a determination of the character and degree of abnormality present; second, a careful study of all conditions having a direct or indirect bearing upon its etiology, with an effort to determine whether or not the cause or causes are still operative; third, the extent of the changes necessary to restore the parts to normal function."

To this I should add a careful search for any biologic factors or mechanical forces that may influence orthodontic treatment. Some of the more important things to include in making a diagnosis are:

First, a history chart upon which should be listed hereditary traits and characters; environmental conditions, past and present; sources of nutrition in infancy; childhood diet; tuberculous or specific diatheses; diseases; habits; stage of development and growth of the body and of the jaws and teeth; general physical condition; functional disturbances; condition of the nasal passages and nasopharyngeal space; individual peculiarities and malformations; physical condition of the teeth and contiguous tissues; types; nationality; sex; age; habits; and occlusal classification.

Second, a good set of models obtained from accurate impressions.

Third, a complete radiographic survey.

Fourth, good clear photographs. These should include at least a profile and a front view.

Fifth, a chart to determine the relationship of the dental arches, one to the other, their approximate size and shape and the distance the teeth should be moved.

Sixth, measurements to determine as nearly as possible the relationship of the jaws to the other bones of the face and to the cranium.

Seventh, a careful examination of the jaws and dental arches to determine, if possible, whether the perversion is the result of one or a combination of both, and whether there is a constricted apical base in either the maxilla or the mandible, or in both.

All of these things should be correlated and a careful and thorough study made before deductions are arrived at or conclusions recorded. Information is available to cover all of these points, and the orthodontist who fails to use it is certainly remiss in his duty to the patient and to himself.

The next problem related to treatment is the age at which orthodontic interference is indicated. This is still a moot question. It has been discussed pro and con by various men and by various groups over a long period of time, and a diversity of opinion still exists. As a matter of fact, the proposition largely resolves itself into a matter of judgment gained by experience and, I may say, by the prevailing opinion of the individual orthodontist from time to time according to his humor. There are too many individual variations in the cases brought under observation to establish a definite or arbitrary rule by which all cases can be governed.

In my own experience when treatment was indicated, the best results have been obtained between the approximate ages of seven and twelve years. However, there are some cases which should be treated at an earlier age and some may be treated later. I am inclined to follow the practice of restoring correct occlusal relationships without delay regardless of the age in cases where the teeth are definitely locked in malpositions, and it is quite certain that the correction of an abnormal mesiodistal relationship of the arches should not be postponed.

The third problem related to treatment and which is of prime importance is the selection of a suitable appliance. It is my opinion that there has been no appliance devised as yet which meets all of the requirements of treatment and

is applicable in every case, and the person who limits himself to the use of any one particular type of appliance is imbued with an erroneous conception of his responsibilities. The wise orthodontist is one who has at his disposal a selection of appliances, the technic of which he has mastered and with which he is skilled in the application, operation, and management.

An appliance to be useful and efficient must possess certain basic principles. It should be made of a material which can be bent and shaped without injury and which will permit soldering without change of temper; strong enough to withstand the natural force of mastication and impervious to the effects of the action of mouth secretions. It must be constructed to provide adequate anchorage so that there will be no distortion or change in position by the application of force. It should be delicate though strong, simple though efficient, cause the minimum interference with function, and permit reasonable prophylactic care by the patients. An appliance should consist of as few parts as may be necessary to meet the requirements of the case and should be so constructed that component parts can be added or taken away without destroying the original design. It should permit individual tooth movement and control, exert only force enough to cause the teeth to move, be capable of moving a tooth in any desired direction and should be under the control of the operator only. An appliance should be changed as often as is indicated and should be simplified when possible, as treatment progresses. It is poor practice to continue to treat a case with an appliance which may have been required in the beginning, which has performed its function and could be replaced by a more simple design. In the treatment of all cases, appliances should be eliminated as rapidly as possible. Before beginning treatment, careful attention should be given to the condition of the health of the mouth, all reparative work taken care of, broken-down and diseased teeth removed, and any lesions of the soft tissues corrected. Appliances should be inspected carefully at each visit of the patient to determine whether any injury is being done to either the teeth or the soft tissues, and frequent periodical examinations made for the detection of cavities in the teeth. Prophylactic care is indispensable. In addition to the care given by the orthodontist and dentist, the patient should be required to follow prescribed instructions.

Still another problem related to treatment is the use of the x-ray examination. There are many indications for its use before, during and after treatment.

The following quotation from my paper read before the Orthodontic Section of the American Dental Association Meeting in Washington, D. C., October, 1929, indicates some of the more outstanding uses before treatment is begun and a diagnosis made.

"To disclose anatomical variations, if any—the character and condition of the bone—the presence or absence of anomalous growths, tumors, cysts, etc.—anomalous or supernumerary teeth—unerupted permanent teeth and the relationship and position of their crowns—stage of development of the permanent teeth—and state of resorption of the roots of the deciduous teeth.

"To disclose and localize impacted teeth—to study the condition of the roots and adjacent tissues of pulpless teeth—to observe the condition of the septi and contiguous parts—and to disclose cavities in the crowns of the teeth which are otherwise unobservable.

"The following are indications for the use of radiograms during treatment:

"To observe the condition and stage of resorption of the roots of the deciduous teeth, especially when their removal is indicated—to indicate the condition and relationship of the roots of teeth that are being moved and observe any change that may occur in the character of the bone during tooth movement—to study the condition of the tissues contiguous to impacted teeth and when molars are moved distally to observe the effect upon the teeth posterior.—

"The radiogram may also be used to observe the fit of orthodontic bands and determine whether there is an encroachment upon the soft tissues—to study the effect, if any, upon the septi and investing tissues during tooth movement and any pathological condition that may arise—in case of an accident to determine the extent of fracture, if any,—when a tooth is broken, particularly an anterior tooth, to determine the proximity of the fracture to the pulp chamber—to observe the progressive development of unerupted teeth and use as an adjunct in the examination of the teeth for cavities—after the active treatment has been completed and the case is under observation, the radiogram will be useful for many purposes—in a mixed denture where the resorption of the roots of the deciduous teeth have been delayed or are resorbing unevenly to determine the time for the removal of such teeth—during the transitional period of permanent occlusal adjustment to observe the relation of the roots of teeth that have been removed—to study and record the condition of the roots of teeth that have been partially resorbed during tooth movement—and to observe and record the stages of development of the third molars and when they are directed towards impactions to assist in determining the correct procedure in treatment."

Another vital problem confronting the orthodontist is the extraction of the teeth in treatment. There is at present a widespread discussion of this subject, and unless it is tempered with good sound logic and an intelligent interpretation, serious consequences may follow. The doubtful situation which exists in Europe at the present time makes one somewhat apprehensive of the end-results. A considerable part of the program of the Second International Orthodontic Congress held in London was devoted to this subject, and it is quite likely that the deductions will be misunderstood by most of those who are not familiar with modern orthodontic practice. The inexperienced orthodontist may be deceived by some of the arguments propounded for the extraction of the teeth, and it is quite certain that the members of the dental profession will be. There are unquestionably some cases of malocclusion where extraction is indicated, but such a procedure should never be followed unless one is thoroughly familiar with the whole subject and not until after the most careful consideration has been given the case.

It has been proposed that in those cases in which there is a constricted apical base, the loss of four premolars, two maxillary and two mandibular, is indicated in order that the dental arches may be reduced in size and brought into better harmony with the body of the jaws. Obviously, if this method is to be followed, one must be familiar with all of the factors concerned, and have the requisite qualifications thoroughly to understand the case. This proposal is not confined to Class I cases, but is made applicable to certain cases in Class II, division 1, Angle classification. I do not recall in my experience any case in this class where the loss of four premolars was indicated or advisable. The treat-

ment consists of reducing the size of both arches by moving the anterior segments distally and lingually and then shifting the occlusion mesiodistally, by moving either the mandible forward, the maxillary arch posteriorly, or a combination of both. It is conceivable that there are some cases in both divisions of Class II where the extraction of two maxillary premolars is advisable, also the loss of one maxillary premolar in both subdivisions, and the removal of two mandibular premolars in certain cases of Class III. The extraction of the maxillary or mandibular second molars may be indicated in some cases in all three classes, and the removal of certain teeth in mutilated cases may be advisable. The removal of third molars is frequently necessary, but that is another question and does not fall in this category.

It is not possible to classify the cases in which extraction would seem advisable. Since there is no general rule that can be applied, each case must be treated individually and as a separate entity. In considering this question, we must not be unmindful of the fact that the face of the orthodontist is turned toward an ideal, the ideal of normal occlusion, and if this fundamental principle is disregarded, it may lead into a state of utter confusion and uncompromising embarrassment.

The last problem to which I wish to call attention is the necessity for the judicious extraction of the deciduous teeth. This may be done for the purpose of prevention, for accentuating the completion of a case and for permitting the first permanent molars to interdigitate in a correct mesiodistal relationship. There are numerous cases in which the removal of the deciduous teeth at the proper time will either prevent or lessen the severity of malocclusion. The distance between the mesial surface of the first permanent molar and the distal surface of the lateral incisor occupied by the three deciduous teeth is practically always adequate for the accommodation of the three permanent teeth which are to succeed them. There is, however, a considerable difference between the mesiodistal diameter of the deciduous and that of the permanent teeth which replace them. The canine is smaller, the first molar slightly larger, and the second molar considerably larger. Thus if the first and second molars are lost and the succeeding teeth erupt and are permitted to occupy the entire space between the first permanent molar and the deciduous canine, the permanent canine after the loss of the deciduous tooth will not have sufficient room in which to erupt.

It not infrequently happens that these three teeth are lost in the maxillary arch while still retained in the mandibular with the result that the three permanent teeth, first molar and two premolars, shift forward into a mesial occlusion, and the canine is either partially or entirely crowded out of alignment. It is, therefore, evident that since the three deciduous teeth, the two molars and the canine, are of about equal mesiodistal diameter in both the maxillary and the mandibular arches, the loss of the mandibular teeth should precede those of the maxillary if the correct mesiodistal relationship is to be maintained. The removal of the first deciduous molar and canine at the correct time will often allow the permanent canine and premolar to erupt in better positions. It is perfectly obvious that deciduous teeth should be removed when the roots are being resorbed unevenly and are causing the deflection of the succeeding permanent teeth and when they are retained to the point that interference in the comple-

tion of a case is manifest. The proper time for the removal of the deciduous teeth can usually be determined by x-ray examination.

Time will not permit further discussion of this subject, although there are many other problems which may be included in this category. The object of the presentation will be attained if it influences you in some degree to give more serious consideration to the various problems related to orthodontic treatment.

DISCUSSION

Dr. Claude R. Wood, Knoxville, Tenn.—It was with a great amount of interest that I read this paper. One of the first problems which the essayist brought to our attention is the need of a correct understanding as to what orthodontia is, and the difference between the old mechanical and the present physiologic conception of tooth movement. He emphasized that we should now recognize that we are not dealing with an inert, nonresponsive body, but with "a delicate, intricate and complex living organism."

Growth, with all of its complexities, is the basic principle which causes a tooth to change its position. The appliance is only an aid, in so far as it acts as a stimulus; therefore unless one has the proper concept of bone growth, and unless one thinks and believes that orthodontic treatment is a growth problem, an orthodontic appliance cannot be used intelligently. When an orthodontic appliance is placed on the teeth of a child and pressure is applied to the teeth, the changes that take place are the result of the change in the supporting tissues. Stimulation is necessary both for formation and also for preservation and growth of bone. This stimulating effect is necessary and may be looked upon as being of a mechanical origin intermittent though it be and comparable to a stimulus produced by an equal amount of pressure from an outside origin. It is essential that we also recognize the periods of growth whenever possible, because the best responses to orthodontic treatment are obtained during these times.

I wish to commend the statement that "The first problem related to treatment is to make a careful and painstaking diagnosis, and every available means at our command should be employed in doing so." It is often true that we do not take enough time to diagnose our cases thoroughly. We are prone to start constructing an appliance and to leave the thorough diagnosis in the background, often to our sorrow. The list included in making a diagnosis is exceedingly commendable and worthy of study. It is so complete that a discussion on these points could only be an elaboration of the several different points mentioned.

The selection of an appliance is a timely problem, and one which has a most decided end-result. The essentials as outlined by the essayist are important. One of the most important is stability of anchorage. Enough could not be said on this subject. It is an absolute requirement of a regulating appliance, and all possible care and precaution should be used in securing anchorage.

Use of radiograms in orthodontia will solve many problems, in fact it will eliminate many problems that are forced upon us if we use x-ray examinations in time.

Extraction in orthodontia will always be a moot question. Difference of opinion will exist as long as orthodontia is practiced. The essayist has treated this subject in a rather definite manner, and I am in complete accord with the views expressed in his paper. I think that extractions are certainly indicated in some cases, but the operator should be very careful in the selection of these cases. I think he will find that most of those cases are found in patients from fourteen years of age and older, rather than in younger patients. In advocating extraction it is easy to give the wrong conception of it unless one is very careful as to the type of cases referred to and the end-result one expects to accomplish. A study of the individual is necessary, giving particular consideration to the profile and the features, also to the size of the teeth and the relation of the arches to each other.

As stated in the paper, there are many other problems related to orthodontic treatment, but a careful consideration of those mentioned will be well worth the time of every orthodontist, and I wish to compliment Dr. Casto on the timely thoughts expressed and the forceful manner in which they were presented.

SOME COMMON PROBLEMS OF ORTHODONTIA AND OTOLARYNGOLOGY*

By Frederick E. Hasty, M.D., F.A.C.S., Nashville, Tenn.

PERMIT me to state that in my opinion the practice of medicine and dentistry should be one profession to the extent that a good part of the training of each should be in common with the other, and that in reality the one profession should be divided into specialties. I am sure that better knowledge of dentistry would make the otolaryngologists more competent in their work. This applies particularly to orthodontia. In the practice of medicine we have before us two great objectives—prevention and cure of disease.

In recent years there has been increased interest in the prevention of disease, or of conditions which would be conducive to the development of disease within the human body. Orthodontia might be classified as very largely preventive in its objective. My slight knowledge of orthodontia is augmenting considerably my ability to prevent and cure diseases in the nose and paranasal sinuses.

Otolaryngologists and orthodontists would derive great mutual benefit by more cooperation in their practice. In recent years otolaryngologists have been particularly impressed with the importance of preventive measures in dealing with pathologic conditions about the head. For practical purposes let us divide, so far as otolaryngology is concerned, orthodontia into preventive and curative measures.

Prevention. Casual study of the anatomy and physiognomy of the human face and head will, I think, promptly lead one to wonder if there is some reason for the disturbance in the development of the face in a great many people. Just what the underlying cause of this derangement of development is I do not know. It would seem likely, however, that our modern mode of living plays an important part.

Surprising as it may seem, as far as air and living conditions are concerned, the middle and upper classes of people perhaps are worse situated than those who are less fortunate in the possession of worldly means, and consequently live in loosely constructed homes where there is, at all times, an abundance of fresh air and no overheating of living quarters. The atmospheric conditions undoubtedly play an important part in the proper function and development of the nose and adjacent structures. It is not at all uncommon to see a mother keep her infant in stale, dry, hot air. This is conducive to congestion and dehydration of the delicate membranes in and about the nose. There is a tremendous change of the nose and paranasal sinuses during infancy.

I approach the subject from this angle with the hope of conveying the idea that in the practice of orthodontia you are dealing with conditions which

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have already developed in quite an abnormal way. Something has happened before you received the patient, and except for whatever influence heredity may have on these individuals, you, as orthodontists, and we, as otolaryngologists, should spend considerable thought and energy in attempting to determine why our patients come before us with conditions which are not normal.

There is yet another very important phase of this early developmental process in infancy—that is nutrition. In these times the literature on nutrition is quite abundant. It seems that almost any person can advise his neighbor regarding dietetics. The interest in dietetics is quite worth while, and if we can manage to control within decent bounds the claims of the manufacturers of food, great good should come as a result of the general interest in nutrition. Unfortunately, however, people are now undoubtedly unduly influenced by commercial advertising.

Otolaryngologists are accustomed to feel that nasal obstruction results in one or more of the following conditions: disalignment and deformities of the nasal septum. This seems to be particularly true when the palate is pushed upward. The displacement or irregularity in the nasal septum obstructs ventilation and drainage through the nose. Pneumatization and the development of the rudimentary paranasal sinuses are thought to be stimulated by the gentle and constant pressures of the current of air in normal respiration. This argument is not altogether infallible. Experience does seem, however, to justify the presumption that in the majority of infants and children proper ventilation does play a most important part in the development of the cavities of the nose and adjacent structures.

This seems to be true not only of the bony walls, but perhaps more important of the mucous membrane lining the nose and adjacent structures. It seems quite possible that obstruction in the nose during early life results in a poorly developed mucous membrane, one which becomes entirely too thick when irritated, one which perhaps is unduly susceptible to the invasion of bacteria beneath the protective coats. I have in several instances seen complete change in the appearance of the mucous membrane of the nasal passages after the proper orthodontic measures had established needed ventilation and drainage. The mucous membrane, like the skin, is a protecting coat, and if it does not properly develop we are simply left susceptible to invasion. In the practice of otolaryngology it is a common occurrence to see two persons living apparently under the same conditions, one constantly in trouble as a result of upper respiratory infection, the other seldom having trouble, recovery being prompt should respiratory infection occur, while in the first-mentioned individual recovery is practically impossible during the winter months. The development of resistance in two such individuals is not due altogether to the condition of a mucous membrane. What has been said of the developmental influences on the nose may be similarly applied to the development of the throat and larynx.

The so-called "adenoid faces" have long been recognized as indicative of nasal obstruction. Treatment of these conditions has in the vast majority of cases consisted in the removal of tonsils and adenoids, a procedure which is in a good many instances followed by considerable improvement. All too often, however, little or no improvement results, because of the fact that at the time of the

operation the removal of the adenoid did not obliterate the obstruction, which at that time was really due to malformation of the mouth and nose, requiring orthodontic measures. This is the one most common mistake being made by otolaryngologists, and perhaps more often by physicians who feel themselves competent to remove adenoids and tonsils, but who are, as a matter of fact, not very well acquainted with the diseases of the nose and throat. While they may efficiently remove the tonsils and adenoids, they may fail to get satisfactory results and to give the patient the desired relief, due to the fact that they do not recognize the underlying condition as an orthodontic problem.

The middle ear and mastoid are so intimately associated with paranasal sinuses and the throat that infection in the middle ear and mastoid is in the vast majority of instances secondary to infection in the nose and paranasal sinuses. Because of this fact the ears too are definitely influenced by the structure and function of the nose and adjacent structures.

Orthodontists should take upon themselves the responsibility of teaching the medical profession, and the otolaryngologists particularly, sufficient orthodontia to make these men capable of at least recognizing those patients who are in need of orthodontic treatment. Orthodontists should learn from otolaryngologists and physicians in general about the influence of proper ventilation and aeration of the whole respiratory tract. They should have an appreciation of the importance of sufficient air intake to allow complete oxidation within the body, for this has a direct bearing upon the function of the body as a whole. I have seen a correction of malformation in the nose change a dull, apathetic, irritable, disagreeable child into a vigorous, vivacious, affable, and pleasing one. There is resting upon the orthodontist the tremendous responsibility of teaching the dental and medical profession, and also the laymen, something of what it means to a child to have a properly developed mouth and nose. Like otolaryngology, orthodontia as a specialty is yet young. The two professions are so closely allied in their objectives that there should be the most thorough and sympathetic cooperation between them.

In recent years otolaryngologists have become very much interested in diseases of the paranasal sinuses in children. This condition, in some localities, for a period of time was treated almost wholly by surgery, and while the immediate results following surgery seemed satisfactory, the surgeon soon found that he was confronted with a return of infection in these cavities and that the openings he had established at previous operations with the idea of allowing drainage had become closed, and that if the condition was to be treated from a surgical standpoint it was necessary again to establish openings. In other words, permanent cure has not been sufficiently obtained to justify the employment of surgery alone in all of these cases. There were other men, who with the same condition, adopted a more conservative management, and while their results were not immediately as spectacular, the end-results were more satisfactory.

Between these two rather extreme methods in caring for infections of paranasal sinuses in children there has not yet been adopted a standardized method of establishing drainage. The tendency, however, is in favor of less surgery and more so-called medical treatment and management. I am of the opinion that in dealing with these conditions there is a wonderful opportunity for cooperation

between the pediatrician, the otolaryngologist, and the orthodontist. Regardless of the etiology of infections of the paranasal sinuses in children, the principle of treatment is always the same, namely, drainage. It is in this undertaking that the orthodontist can frequently render invaluable service by so guiding the development of the arch as to give the greatest possible space within the nares. I realize that this procedure requires time and that it does not apply in the management of acute conditions. It can, however, give invaluable assistance in the way of preventing recurrent exacerbations by establishing ventilation and drainage of these cavities.

As has been suggested, orthodontia and rhinology are as yet young specialties. The practice of rhinology in children has come into prominence in such recent years that the rhinologist and the orthodontist are both yet lacking in experience and knowledge in the proper management of these conditions.

We have at our command as aids methods which are not being employed. This applies particularly to the clinical and the roentgenological laboratories. In the clinical laboratory there is found valuable assistance in the way of differential diagnosis as to whether rhinorrhea in a child is produced by infection or is simply a result of an allergy. An increased eosinophil count in the smear of the mucus from the nasal passages may offer valuable information in the way of differential diagnosis. The white count is at times of significance; the hemoglobin may give a valuable index as to the state of nutrition and probable resistance of a child. Roentgenology can be used to great advantage where the child can be induced to cooperate reasonably in the making of films. Too many men have accepted the statement that roentgenograms of mastoids and paranasal sinuses in children less than ten years of age are of little or no value. I contend that if the patient will cooperate, roentgenograms should be obtained that are just as dependable and valuable in the way of diagnosis as in those of adults.

I should like further to call your attention to what I consider to be perhaps the most important point in the study and management of paranasal sinus disease; it is, as stated by some anatomists, that the ethmoid cells are the only group of paranasal sinuses that are constantly present in the newborn. This is perhaps not quite true; for even if the other sinuses are not definitely developed, there are the rudiments of these sinuses present and they are actively in the stage of development. I shall show you a little later some films made of children as young as three years in which you can see fairly well-developed sinuses of every group. For practical purposes I feel that the ethmoids should be regarded as the original location of infection in the paranasal sinuses in practically all cases where there is disease, with the exception of those cases in which the infection extends from without to within the cavity. Particularly is this true in the maxillary sinuses. Granting that the infection is usually located in the ethmoid cells, you will then find that drainage from these structures is likely to contaminate the maxillary sinuses and that in expiratory efforts the infection may be forced into the frontal sinus. The sphenoid sinuses are not as often diseased as is commonly expected. Circumstantial evidence in support of this theory may be found in practically all adults, who when subjected to satisfactory roentgenologic examinations of the ethmoid cells will show some evidence of pathologic changes. I think that increasing the intranasal space will allow freer

drainage of the ethmoid cells, and if there is not obstruction in these passages, infectious material from the ethmoid cells is not likely to be forced into the other adjacent cavities.

I should like to submit for your consideration the following x-ray films with the hope of demonstrating the anatomy of the paranasal sinuses in children of different ages, and also of demonstrating how it is possible with good roentgenograms to detect definite diseases in the paranasal sinuses.

B. Z. age three suffered with repeated colds, and nasal obstruction. The films outline the anatomy of the sinuses and show definite evidence of disease in the ethmoid cells. Proper treatment gave prompt relief.

B. J. W. age six. This is another case in which the removal of tonsils and adenoids failed to relieve nasal obstruction. It can be clearly seen that the left ethmoid and left sphenoid are diseased. It was necessary to remove a large polyp from beneath the region of the posterior ethmoids. The child is slowly yielding to treatment.

G. H. age nine. This boy's adenoids and tonsils were removed four years before these films were made. He continued to have frequent and severe colds. These films indicate disease in the ethmoid cells and antra and outline the anatomy of the ethmoid and sphenoid cells. There were small polypi beneath both middle turbinates at the time these films were made. Intranasal treatment and no surgery gave complete relief.

M. D. age twelve. This is simply to demonstrate the anatomy in a child who has had tuberculosis. There was nasal obstruction as a result of malformation of the arch. The sinuses are not developed as they should be at this age.

G. Y. age thirteen suffered with asthma. The original films showed some evidence of disease in the ethmoid cells. This later film was made after orthodontic procedures had been instigated. Intranasal space was increased and his asthma cleared up. The second film was made just recently after the boy had had a severe cold and his asthma had returned. As the film indicates, the boy has disease in the left ethmoid. Treatment established drainage and the boy is now free of asthma.

CONCLUSIONS

1. Dentistry and medicine should be divisions of one profession.

2. Malformation in the development of the mouth definitely influences the development of the nose and paranasal sinuses.

3. The anatomy of the nose and paranasal sinuses, to a great extent, determines the function of these structures and the likelihood of their undergoing pathologic changes.

4. If corrections of malformities of the mouth are made sufficiently early, diseases in the paranasal sinuses may be prevented or cured.

THE BIOLOGIC EFFECTS OF ULTRAVIOLET LIGHT*

By John Loofbourow, Cincinnati, Ohio

I WISH to present a brief survey of the historical background that has led up to present developments in ultraviolet therapy, the highlights of present-day opinion regarding the biologic effects of ultraviolet light, and its particular, certain developments in this field which have come from the Basic Science Research Laboratory at the University of Cincinnati.

A few words regarding this laboratory may be apropos by way of introduction. For many years, President Hermann Schneider of the University of Cincinnati had in mind the organization of a laboratory for research in pure science which would include workers trained in all the various fields of science, and the object of which would be the breaking down of the artificial barriers between the sciences and the study of problems in borderland fields. President Schneider was finally brought in contact with a young man, then about to graduate from the University, who had a similar broad attitude toward science.

This young man, Professor George Sperti, the director of the laboratory, started to work, in a small basement room in one of the University buildings, on the problem of applying the quantum theory of physics to the action of light rays on biologic materials. As time went on, he surrounded himself with a staff of chemists, physicists, doctors of medicine, biologists, mathematicians, and men and women trained in various other fields, always with the thought in mind of selecting workers equipped with sound fundamental training and having as well the ability to work cooperatively and understandingly with specialists in alien fields.

During the past several years, the laboratory has grown considerably, and many developments have come from it. A large number of these have had to do with the biologic effects of light rays. I shall discuss some of these developments.

Before considering the biologic effects of ultraviolet light, it might be well to review briefly some of the physical characteristics of light.

When the ancient Greek civilization was in its glory, light was looked upon by the philosophers of the time as being either a kind of walking stick projecting out of the eye of the seer to the object seen, or a series of pellets shot into the eye from the visible object.

Little thought was given to the possibility that light might be of various kinds, until about 250 years ago. The fact that various objects have different colors was not associated with the idea of various kinds of light, but was thought rather to be an inherent property of the objects themselves.

The rainbow, however, caused some persons to ponder as to whether or not it was possible that light itself might be made up of a number of different colors. When travelers to China and other parts of the Orient during the

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Middle Ages brought back stories of highly prized glass prisms which gave out colors when white light was sent through them, more and more individuals began to wonder about the relationship of light to color.

Roughly a quarter of a century ago, the scientist, Robert Boyle, in England, suggested that when white light is sent through a glass prism it becomes colored because the prism modifies the light in some way so as to give to it the property of color.

The true explanation, however, came from Sir Isaac Newton, who, in 1666, demonstrated to his own satisfaction that all of the colors were present in the white light that enters the prism, and that the prism merely serves to separate them one from another. He sent a beam of white light through a prism, which spread it out into the band of colors we call a "spectrum." Then he sent each of these colors in turn through a second prism. There was no further color change, indicating that the second prism was unable to effect a change in color once the different colors of white light had been separated from each other. As a further proof of the composite nature of white light, he recombined the different parts of the colored spectrum by means of a second prism turned in the reverse direction to that of the first, and demonstrated that this mixture resulted in white light.

There next arose the question: what is responsible for the different colors? Could the red light be due to one kind of particles and the blue to another? Could light be a kind of wave motion, like waves of water or sound waves in air, and could the different colors be due to different types of waves? These questions remained a puzzle until little more than one hundred years ago, when some very convincing evidence was brought forth by Dr. Thomas Young, a physician in England, and Augustin Fresnel, a road engineer in France, to prove that light is a kind of wave motion, very much like water waves, moving in an invisible medium that fills all space. They demonstrated, further, that the different colors are due to different frequencies, or wave-lengths (the wave-length being the length of one complete wave; for example from peak to peak or from hollow to hollow). Their experiments showed Newton's spectrum to be a band of light spread out according to wave-lengths, with the longest waves at the red end and the shortest at the violet end.

Eventually it was discovered that the spectrum extends beyond the visible at both ends. By placing a thermometer beyond the red end of the spectrum under suitable conditions, a rise in temperature is recorded. Measurement of these invisible rays with suitable equipment indicates that they are of longer length than the visible rays at the red end of the spectrum. Because they border the red, they were named "infra-red light."

Similarly, it was found that a photographic plate is blackened beyond the blue end of the visible spectrum. These invisible, chemically active rays were named ultraviolet because they occupied the position beyond the violet end of the visible spectrum. They represent waves of shorter length than the shortest visible rays.

About 1870, James Clerk Maxwell, the famous British physicist, deduced on the basis of certain mathematical considerations that light of all kinds is an electromagnetic wave phenomenon. Since that time, x-rays, gamma rays of

radium, radio waves, and cosmic rays (as well as visible light, ultraviolet light, and infra-red light) have been shown to partake of the common properties of a velocity of 186,000 miles per second, and an electromagnetic wave nature. By suitable equipment, one can now spread each of these kinds of rays into a spectrum of various wave-lengths. If we construct a chart showing all of these electromagnetic radiations in a complete electromagnetic spectrum, we have, beginning with the longest waves and lowest frequencies: first, electric waves (including those used for radio transmission); next, infra-red or heat waves; next, the visible spectrum (starting with red, then orange, yellow, green, blue, violet, in order); next, the ultraviolet region; then the soft x-ray region; then the hard x-ray region; followed by the gamma rays of radium, and finally the little known cosmic rays, that supposedly come to us from interstellar space.

It is with the small region in this complete spectrum known as the "ultraviolet" that we are particularly concerned, and we shall see that the biologic effects of rays in this region are very intimately connected with their wavelength—or, what is equivalent, with their position in this electromagnetic spectrum.

There are three primary effects of ultraviolet light on living things and biologic materials. First, there is their destructive action for cell life, most strikingly evidenced in the powerful manner in which they kill bacteria and other microorganisms. Second, there is the stimulative or growth-promoting action which a number of workers have found them to produce not only among simple cells but in higher forms of plant and animal life. Third, there are particular and characteristic biologic reactions resulting from the photosynthesis of certain chemical materials. Often two or more of these effects take place simultaneously, and much of the confusion that has arisen within the past fifty years regarding the effects of ultraviolet light has been due to the failure to distinguish between these different effects and the failure to study individually the different portions of the spectrum responsible for them.

The knowledge that ultraviolet will kill cells is quite old. Downes and Blunt stated in 1877 that bacterial suspensions are inhibited in growth when placed in the light, and they believed the ultraviolet portion of the sun's spectrum to be particularly responsible for this effect. They were followed by Duclaux in 1885, Arloing in 1886, and Roux in 1887, all of whom confirmed the bactericidal action of light rays.

Marshall Ward published a series of paper from 1892 to 1894 in which extensive investigations of the effects of light on anthrax spores were recorded. He concluded that the ultraviolet rays are primarily responsible for the bactericidal action.

It had been suggested that the killing action was an oxidation process, and that consequently the presence of oxygen was necessary for the bactericidal effect. Wesbrook in 1895 confirmed this viewpoint, but it is now known to be erroneous for most types of microorganisms.

The therapeutic application of the killing effect of ultraviolet orginated, as far as I have been able to ascertain, with the experiments of Finsen at the Finsen Institute in Copenhagen, as reported by his assistant Valdemar Bie in

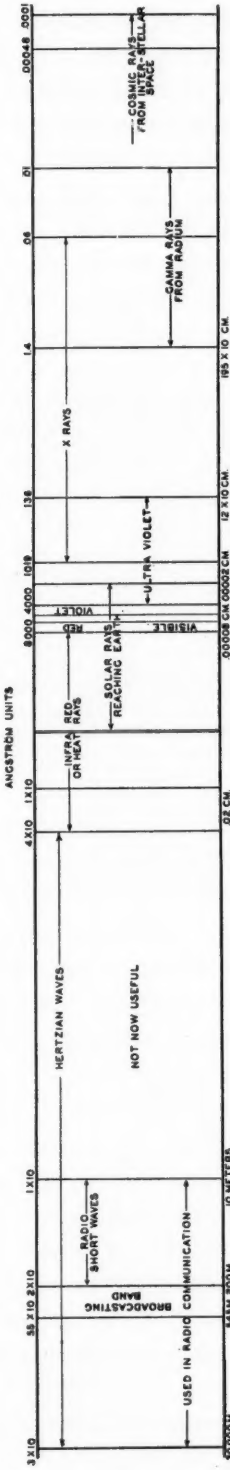


Fig. 1.—The complete spectrum of electromagnetic waves.

1899. Using sunlight in summer and carbon arcs in winter, with arrangements for concentrating the light rays and provisions for filtering out the infra-red or heat rays, Finsen obtained remarkable results in the treatment of hundreds of cases of lupus (tuberculosis of the skin) and other skin infections. The ultraviolet treatment of lupus remains essentially the same in principle today.

After 1900, particular attention was paid to the part of the spectrum responsible for the bactericidal action. Barnard and Morgon, for example, in 1903 exposed plates of bacteria to a spectrum and concluded that the ultraviolet region only was effective in killing the microorganisms. Browning and Russ, by much more careful experiments with a similar technic, demonstrated in 1917 that, at least for a number of bacteria, there is no appreciable killing effect of light except in a band in the ultraviolet between 2960 and 2100 Angströms. (It may be said, parenthetically, that the Angström is a unit for measuring the wave-length of light rays, equivalent to one ten-billionth of a meter.)

The same year, Newcomer came to similar conclusions, using suspensions of bacteria in water, which were exposed to various wave bands in the spectrum.

In 1926, Schneider and Sperti published the "Quantum Theory in Biology," in which they demonstrated that, according to the quantum theory of physics, one would expect such effects as the lethal action and the stimulative action of ultraviolet to begin abruptly at critical points in the spectrum. In other words, according to this theory one should be able to proceed through the spectrum from longer toward shorter wave-lengths without obtaining any lethal action until one suddenly reaches a critical wave-length at which this lethal action should begin, and for all shorter wave-lengths the action should continue. Confirmation of this theory was published by Burger in 1928, also working in the Basic Science Research Laboratory. The conception that the various effects of ultraviolet begin at critical points in the spectrum has led to important developments in the separation of various effects from each other, because it has emphasized the necessity of sharply screening out undesirable regions of the spectrum and sharply retaining desired regions in order to differentiate between desirable and undesirable effects.

The question as to whether the bactericidal action of light is a direct one on microorganisms or the result of effects on the sustaining medium was considered by even the earliest workers. By experiments with the irradiation of media, Downes and Blunt came to the conclusion that the effect is entirely one on the microorganisms themselves. Many other workers have since confirmed this opinion. There are, however, still dissenters to that viewpoint, a paper having appeared as late as 1927 by Bedford in which it was concluded that the bactericidal effect depends largely upon the action of ultraviolet light upon the medium.

Therapeutically, this lethal action of ultraviolet light has been applied since Finsen's time in the treatment of many surface infections, in the promotion of the healing of infected sockets from which teeth have been extracted, etc. An enormous number of clinical records testify to the effectiveness of these applications of ultraviolet therapy.

Whether the gratifying effects obtained in the human host are due to direct bactericidal action of the ultraviolet rays is still a question, however. Many workers have demonstrated that the effective bactericidal rays have very slight penetration into tissue. In view of this fact it is questionable whether many of the instances in which ultraviolet is successful in bringing about a cure can be explained by direct bactericidal action of the rays. Furthermore, the lethal rays are known to destroy human tissue as well as microorganisms. Because of these considerations, there is a growing belief among certain clinicians that the results obtained are primarily due to an increased immunity imparted to the human host by the longer rays of the ultraviolet spectrum rays outside the lethal region. This school favors the use of general irradiation with rays from which the lethal ones have been excluded, in preference to the

Control A B C

Fig. 2.—Ultraviolet stimulation of plant growth (Withrow and Benedict, Bull. Bas. Sc. Res.).

The controls received Cincinnati sunlight, through glass. Plant *A* is from a group which received artificial ultraviolet light from which all rays shorter than about 3130 A. had been eliminated. *B* and *C* are from similar groups, except that the short-wave limit of the rays was 2970 A. and 2650 A. respectively in these two cases. Group B, receiving ultraviolet light of the complete range included in the spectrum of ideal sunlight, showed the greatest stimulation. The shorter rays, beyond the limit of the sun's spectrum, received by Group *C*, masked the stimluative effect to some extent.

local irradiation of infected areas with full ultraviolet. Nevertheless, the practice of the majority at present is to treat local, surface infections and wounds with the local application of unfiltered, full ultraviolet rays, from sources such as the quartz mercury arc or carbon arc which are rich in the radiations in the lethal part of the ultraviolet spectrum.

Let us now turn to a consideration of the so-called "stimulative," or the growth-promoting effects of ultraviolet.

Many of the investigators of the lethal action of ultraviolet on microorganisms believed that they noticed an increased cell division in some cases. It was difficult, however, to determine whether such effects were actually growth-promoting actions or simply the natural development of larger colonies by the few survivors after the killing of the majority of the organisms.

The brothers DeFazi published results from 1915 to 1917 indicating that the growth and fermentation of yeast may be promoted by the proper application of ultraviolet radiations. Their experiments have been the basis of commercial processes in use in Italy, in which ultraviolet is used to promote the fermentation of beer. These experiments have, however, been much criticized by Tanner and others, who have found only killing action of ultraviolet for yeast.

The growth-promoting effect of ultraviolet light on higher plants has been investigated by a number of workers. It is not necessary to consider the individual papers here. It will suffice to say that the majority have found no growth-promoting action, while a few who have experimented with sunlight have obtained positive results.

The positive results obtained with sunlight, together with the failure to arrive at such results through glass, suggested that the ultraviolet near the limit of the sun's spectrum, in the region between 3100 and 2900 Angström units, may be growth-promoting. The mass of evidence showing the bactericidal action of ultraviolet rays shorter than 2900 Angströms suggested that the presence of these rays in the light from artificial ultraviolet sources might mask any possible growth-promoting or stimulative action from such sources, and might account for the negative results obtained under such conditions. With these considerations in mind, various workers attempted to filter out the lethal rays from artificial sources, but without obtaining positive growth-promoting effects.

The quantum theory in biology as worked out at the Basic Science Research Laboratory suggested that both the growth-promoting and the stimulative regions might begin at very abrupt critical points in the spectrum. If such were true, it would be necessary to filter out the lethal radiations very sharply, and the failure of previous workers with filtered artificial sources to obtain growth-promoting effects might have been due to the lack of sufficiently sharp filtering. Proceeding with this theory in mind, Withrow of the Basic Science Research Laboratory developed a series of special filters which allowed the regions from 3100 to 2900 Angströms to pass freely, but which cut out quite sharply radiations of shorter wave-length than about 2900 Angströms.

The results of two series of experiments with coleus and tomato plants using these new filters have recently been published by Withrow and Benedict. They find that the 3100 to 2900 region has very marked stimulative action, as evidenced by increased height and dry weight of the plants, but that this growth-promoting effect is entirely masked if only a little of the ultraviolet energy of wave-lengths shorter than 2900 is allowed to fall upon the plants. Their experiments indicate that the ultraviolet of sunlight in a clear atmosphere at certain times of the year has very appreciable growth-promoting properties, and that lack of this growth-promoting region of the sun's spectrum can be supplied by artificial sources if they are adequately filtered.

The action of this region of the ultraviolet on the promotion of cell division among aggregates of animal cells has not yet been sufficiently investigated. A number of workers are studying the problem, but a report of their findings at this time would be premature. It has been suggested, however,

that such an effect may be responsible, at least in part, for the value of ultraviolet radiations in promoting the healing of wounds.

We now come to the third action of ultraviolet light—its effect on the accessory food factors, or vitamins. I think that this phase of the problem is most interesting, both because it has important bearings upon dental problems and because one of the members of your profession, Dr. Weston A. Price of Cleveland, has made many valuable contributions to our knowledge of the subject.

The history of the accessory food factors dates back to 1897, when Eijkman found that the great incidence of the disease beriberi in Java was due to the habitual use by the natives of a diet of polished rice, and that an unknown factor removed in the rice polishing would prevent the disease.

Similar discoveries were made with regard to scurvy in 1907 by Holst and Fröhlich who showed that certain unknown factors in green foodstuffs were responsible for the prevention of the disease (Kramer had suggested as early as 1720 that green foodstuffs probably prevent scurvy).

Experiments with simple artificial diets for animals—consisting of pure proteins, carbohydrates, and salts—led to further discoveries showing the necessity of accessory factors. From 1906 to 1912, Hopkins in England noted that rats on such artificial diets lost weight and died, whereas if milk was added to the diet they experienced normal growth and longevity. In 1912, Funk proposed the name "vitamin" to include the unknown growth-promoting factors and those responsible for the prevention of beriberi and scurvy.

McCollum and Davis in America, in 1913, found that the ether extracts of either egg yolk or butter would promote the growth of animals on some deficient diets but not on others. Apparently more than one accessory factor was necessary for normal growth. In 1915 these workers came to the conclusion that there were two such necessary substances—a fat soluble vitamin A and a water soluble vitamin B.

It was many years before the fat soluble A was found to be complex in nature. In the meantime, the relation of the fat soluble factor to rickets came under the scrutiny of various workers. As the story goes, it had been the habit of fishermen's wives on the coast of France to feed their babies cod liver oil for many centuries, with the idea that it produced in them better body growth and development. This practice was considered a foolish notion, however, until the experiments of Mellanby in England, between 1915 and 1919 showed the effectiveness of cod liver oil in bringing about proper bone and tooth formation in dogs. The bone deficiency disease, rickets, a result of improper calcium and phosphorous metabolism, was found to yield readily to the addition of cod liver oil to the diet.

In 1922, McCollum showed that the supposedly homegeneous fat soluble A really consisted of two factors, an antixerophthalmic and growth-promoting factor now known as A, and an antirachitic factor now known as D.

A third fat-soluble factor, vitamin E, was shown by Evans and Scott in 1922 to be essential to fertility in rats.

The water soluble B vitamin has now also been separated into an antineuritic and pellagra-preventing vitamin B complex (consisting of two or more factors) and the antiscorbutic vitamin C.

It will be profitable to consider vitamin D first, because that is the one of which the most is known from the chemical and physiologic standpoints.

As early as 1919, Huldschinsky showed that the vitamin D deficiency disease, rickets, could be cured by exposing the patient to the ultraviolet radiations from a quartz mercury arc. Hess and others, in 1921, demonstrated that sunlight is, under appropriate conditions, equally effective.

It was natural for workers to ponder about the possible relationship between the antirachitic dietary addition, vitamin D, and the antirachitic effect of irradiation of the body with ultraviolet light. Eventually the ability of ultraviolet light to impart antirachitic properties to nonactive oils and foodstuffs was tested. From 1919 to 1924 Price, Hess, Steenbock, and others showed that the irradiation of various foodstuffs and oils resulted in their acquiring the power to protect against rickets when added to a ricket producing diet.

The next step was to search for the fraction of these materials activated by ultraviolet light. During 1924 and 1925, Hess, Weinstock, Helman, and others concluded that cholesterol, a solid alcohol, is the proponent of vitamin D. In 1926, however, it was shown by Rosenheim and Webster, Heilbron, Kamm, and Morton, and Pohl that the true precursor of the vitamin is the closely related substance ergosterol, which is present naturally as a contaminant of cholesterol.

Extensive study was then made of the reaction:

$$\text{Ergosterol} + \text{U.V. light} \rightarrow \text{Vitamin D.}$$

It was quickly found that the formation of the vitamin by ordinary ultraviolet light was followed by its rapid destruction. Under the best conditions with full ultraviolet light from a quartz mercury arc only about 10 per cent of the ergosterol could be obtained in the form of vitamin D, because of the rapid destruction of the vitamin accompanying its formation.

The problem had, however, been approached from a different angle by Schneider and Sperti and other workers in the Basic Science Research Laboratory. Reasoning that according to the quantum theory, the activation of provitamin D to vitamin D might begin at a given critical wave-length, and its destruction might begin at another critical wave-length, they had set about to determine these critical wave-lengths. Having found that activation began at about 3100 Angströms, and destruction at about 2900, both actions continuing throughout shorter wave-lengths, it was then merely necessary to eliminate the radiations shorter than about 2900 Angströms and retain the band between 3100 and 2900 in order to obtain activation of ergosterol without destruction.

This process apparently yields a pure vitamin preparation, free from toxic destruction products, and it has the further advantage that it can be applied to the direct irradiation of foodstuffs such as milk to increase their vitamin D potency. Irradiations of such materials with full ultraviolet results in the marked deterioration of taste, odor, color, and nutritive value. The radiations which are screened out to prevent destruction of vitamin D are fortunately the ones responsible for bringing about these undesirable changes, so that their

elimination makes it possible to irradiate various types of foodstuffs without bringing about such changes.

The need for vitamin D in children is self-evident from its relation to rickets, and its necessity for proper bone and tooth formation. Its value in later years in the healing of fractures and the maintenance of proper bone structures has been emphasized by Price in his extensive studies of butter vitamins.

Various workers have suggested a relationship of light to the synthesis of vitamin A, but little is known about this matter as yet.

The importance of vitamin A in increasing resistance to infection was pointed out in 1928 by Green and Mellanby. Price, in 1929, before the American Dental Association at Washington, D. C., reported some of his very extensive work with fat-soluble vitamins of butter, in which he correlated the seasonal variations of sickness with the variations of vitamin A and D in butter. He pointed out the importance of the butter vitamins in preventing pyorrhea and dental caries.

The relationship of vitamin B to ultraviolet light has received attention only from the standpoint of showing its susceptibility to destruction by full ultraviolet radiations. Damianovitch, in 1919, published qualitative spectrographic evidence indicating the relationship of the vitamin B complex to purines and pyrimidines. Recently, Heyroth and I have published material concerning the ultraviolet absorption spectra of various purines and pyrimidines of the cell nucleus, and the changes brought about in these spectra upon irradiating the materials with various bands of the ultraviolet spectrum. We find the spectra of potent vitamin B concentrates to resemble those of certain of the cell nuclear materials, especially such materials as have been irradiated with ultraviolet light under appropriate conditions. Biologic experiments concerning the possibility of synthesizing the vitamin B complex from such materials with light are in progress.

Practically nothing is known about the relationship of ultraviolet light to the other two vitamins, C and E. Vitamin C, the antiscorbutic factor, is particularly interesting, however, because of the emphasis that Hanke of Chicago has placed upon its necessity in the prevention of pyorrhea.

Summing up, one finds, then, three primary biologic actions of ultraviolet light: a lethal action for cells, a growth-promoting or cell-division-promoting action, and a photochemical action in the synthesis of vitamins.

For the lethal or bactericidal action it is necessary to employ an ultraviolet source rich in radiations of wave-lengths shorter than about 2950 Angströms. Typical sources of this type are the quartz mercury arc and the carbon arc equipped with carbons impregnated with metallic salts. In the animal host, however, the bactericidal action may be brought about indirectly by rays of longer wave-lengths through the imparting of increased immunity. For this latter purpose, the consensus of opinion now is that it is better to employ general radiations from a source rich in the rays near the limit of the sun's spectrum but weak in radiations beyond the limit of the sun's spectrum (about 2950 Angströms) toward shorter wave-lengths. For such purposes, sunlight under the best conditions of atmosphere and altitude is considered ideal, and

the attempt in artificial sources is to duplicate the spectrum of the sun under these conditions.

For promoting cell growth or the growth of plants, the region near the end of the sun's spectrum, with the exclusion of other rays, is again required. These rays are obtained either by the use of special sources or by means of quartz mercury arcs or carbon arcs in conjunction with special filters.

There is divergence of opinion as to whether these rays or the full radiations from a quartz mercury arc or carbon arc are better in the promotion of wound healing, the picture being complicated by the fact that the bactericidal action of the shorter rays may be of benefit in such cases.

The photosynthetic formation of vitamin D from ergosterol by ultraviolet light is now well known, and is made use of on a large scale in the prevention of rickets. Through the elimination of the shorter rays it is now possible to form the vitamin without destroying it, and to incorporate it successfully in many food products. The same results may be brought about by general irradiation of the body, preferably with radiations from which the destructive rays have been eliminated. The relationship of ultraviolet to the formation of vitamin A is as yet questionable, but there is evidence to show that it probably plays a part in such formation.

Ultraviolet light is of importance to the dental profession, first, in its ability to prevent rickets and insure proper bone and tooth formation in children; second, in its ability to maintain a proper bony structure in later life; third, in its usefulness to promote the healing of sockets; fourth, in its ability to increase the immunity of the body to infection; and fifth, in its bactericidal action.

DOUBLE HARELIP AND CLEFT PALATE SHOWING THE IMPORTANCE OF PROPER SURGICAL AND ORTHODONTIC TREATMENT OF THE PREMAXILLARY LOBE OR PROCESS*

By Harry E. Kelsey, D.D.S., F.A.C.D., Baltimore, Md.

THE ORTHODONTIC treatment for cleft palate should have for its object the restoration of those portions of the maxillary and premaxillary bones and the teeth implanted in them, to as nearly a normal position as possible.

This insures the best adaptation of such portions of those structures as are found to be present, to the normal functional service for which they are designed, while the natural teeth are still present in them, and leaves them in the best possible condition for such artificial restorations as are required at the time because of the absence of some of the teeth, and also for the more extensive restorations later in life in case other teeth are lost.

To no part of the orthodontic procedure does this apply more strongly than to the premaxillary lobe or process, which is found in cases of double cleft. The tying in of this process between the anterior ends of the lateral halves of the maxilla is the most important step in the surgery of the case, so far as it relates to the future function and usefulness of the denture, and if it can be placed in such a position that the incisors (usually only the two centrals) which it contains may erupt in as nearly a normal position as possible, it will of course be better for the patient and for the orthodontic treatment, which is practically always demanded later on. This is of course difficult, inasmuch as the operation is usually done very soon, if not immediately, after birth, and consequently we do not often find this process in an ideal position. In most of the cases which I have seen it is rotated, with the lower portion situated too far lingually, and the upper too far labially, as is shown in this case. The important point is that the process has not been eliminated; it is there, and therefore orthodontic treatment offers possibilities of improvement which could never be realized if it had been lost. Removing this premaxillary process and bringing the ends of the maxillary bones together leaves a caved-in appearance to the face, which can never be fully rectified even with all the possibilities offered by the plastic surgery of today, and this mistake is still often made.

I regret that I cannot show a photograph of the patient, but I hope to do so sometime in the future when treatment has been completed.

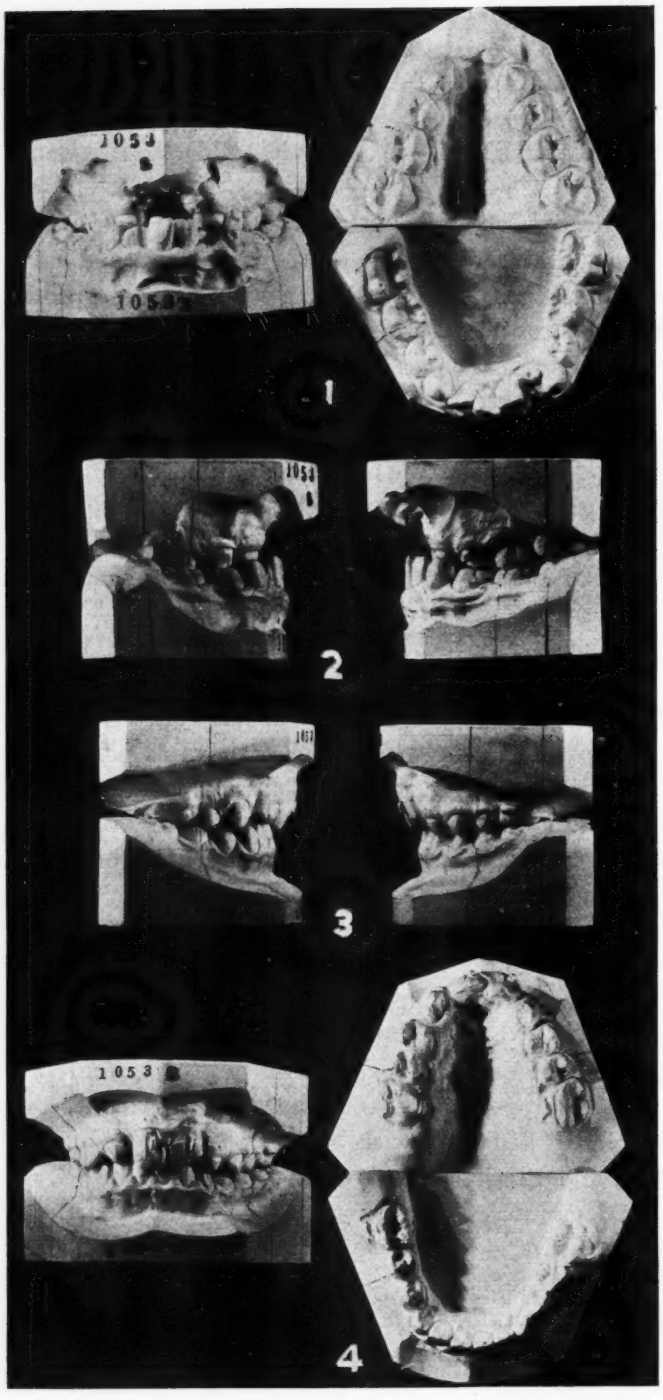
Fig. 1 shows the front and open view of the denture. The incisors in the premaxillary process are pointing almost directly backward toward the throat, which gives the appearance of this process having been removed.

Fig. 2 shows right and left side views of the denture at the beginning of orthodontic treatment.

Fig. 3 shows right and left side views taken four years later.

Fig. 4 shows front and open view of denture, same date as Fig. 3.

*Paper presented at a meeting of the Southern Society of Orthodontists, Cincinnati, Ohio December 1-3, 1931.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In revolving and bringing down the premaxillary lobe, the fissures usually still existing at some point around it, most often posterior to it and through which communication with the nose can be frequently demonstrated by means of a probe, have not been opened. Patient's speech shows marked improvement.

I should have said that the other orthodontic requirements of the case, such as widening and general enlarging of the maxillary arch, have not been neglected. The surgery in this case has been excellent, and some further plastic surgery in addition to the orthodontic treatment will nearly obliterate evidence of a preexisting abnormality.

SOME OBSERVATIONS ON MALOCCLUSION OF THE DECIDUOUS DENTITION*

By A. T. Pitts, D.S.O., M.R.C.S., L.R.C.P., L.D.S., London, England

I AM CONSCIOUS of some temerity in choosing for my presidential address the subject of malocclusion of the deciduous dentition, and thus following at a short interval, Mr. Northcroft who has made this subject peculiarly his own. Yet, there is still so much to be learned about the beginnings of malocclusion that I may be pardoned for offering you some discursive reflections on this aspect of orthodontics, with the intention of revealing some of the gaps in our knowledge rather than of providing solid information.

When I qualified, and even after I had held the post of house-surgeon in the Children's Department of the Royal Dental Hospital, I was profoundly ignorant of the existence of malocclusion of the deciduous dentition. I do not think that I was more inattentive than my fellow students, but I cannot recall any teaching which suggested that the many irregularities of the permanent teeth might have their precursors in the deciduous dentition. Apart from caries the deciduous teeth received little attention, and though it might have been admitted that occasionally the deciduous teeth could show variations from the usual arrangement, yet since any orthodontic treatment of these teeth would have been thought by most practitioners to be absurd, the study of the deciduous dentition in any detail was looked upon as unnecessary.

Even today this attitude is not unknown, and the deciduous dentition still awaits detailed study. Perhaps the clue to this curious neglect lies in the fact that any investigation of the irregularities of the deciduous teeth demands a plentiful supply of children ranging from two to six years, so that this dentition can be studied during its functional lifetime and before the permanent teeth have erupted. Even in a dental hospital this material is not plentiful, while in private practice it is still more scarce, so that comparatively few dentists have the opportunity of seeing a large number of young children. When I started working at the Hospital for Sick Children, Great Ormond Street, it was soon borne upon me that malocclusion of the deciduous dentition was far from uncommon, and all my subsequent experience has only served to confirm this impression. I can state without hesitation that irregularities of the deciduous teeth are common, and that practically all forms met with in the permanent dentition can be paralleled in the earlier dentition. I have no statistics to offer you, but I would hazard a guess that at least 20 per cent of young children show some degree of malocclusion. This represents my hospital experience. It is conceivable that an examination of children of a superior social class might show a lesser incidence, though it must not be assumed that the children from working-class homes are for that reason more likely to have contracted deciduous arches.

*Presidential address delivered to British Society for the Study of Orthodontics, February 2, 1931.

Many years ago some statistical work on the eruption of teeth which Warwick James and I carried out on children attending Great Ormond Street Hospital, was criticized on the grounds that the children were "sick children." I felt then that this criticism was unfair, and I would suggest that my impressions as to the frequency of deciduous malocclusion are not invalidated because they have been obtained chiefly from a children's hospital. These children are not usually sick in the sense that they are ailing or generally of poor nutrition. On the contrary, their nutrition is on the whole good, and though they attended the dental clinic because of some dental defect, yet I would contend that they were a fair sample of an industrial urban population. Whether a social grading of the child population in regard to dental defects would show that children from the upper or middle social strata had better teeth or better jaws, is a point on which I cannot offer any opinion worth having, though I should surmise that the children of good social class might show a smaller incidence of certain forms of malocclusion, such as open-bite or the irregularity resulting from the premature loss of deciduous teeth.

I have been able to collect notes and models of a considerable number of cases of deciduous malocclusion, and I propose to attempt a descriptive classification. Broadly speaking, deciduous malocclusion falls into three categories:

1. Those cases which commence *ab initio* and depend on some defective or abnormal growth factor. Thus, some forms of deciduous malocclusion may be predetermined by reason of abnormal bone growth. Some at least of the cases of postnormal occlusion belong to this category, and though it would be paradoxical to speak of postnormal occlusion in a newborn baby, yet there is little doubt that a mandibular retrusion may exist. Similarly, prenormal occlusion—of the inherited type—is undoubtedly another example.

2. Malocclusion which develops subsequently to the completion of the deciduous dentition. Such cases might only be delayed examples of the first group. But I believe that there are cases of a normal deciduous dentition which subsequently become abnormal. The failure of spacing seems to me to be such an example, though perhaps not invariably. The lateral type of open-bite in which the deciduous molars fail to occlude is another. A faulty occlusion may be induced by caries, and a bite of convenience may later on become stabilized, as the anatomical bite.

3. Malocclusion may be due to some external cause, such as habits of different kinds, injury, or disease. This is only a subvariety of the second group, but it is helpful on clinical grounds to differentiate such cases from those in the second class.

I now pass to a consideration of the different types of malocclusion. The difficulty of defining what constitutes the normal is as great in the deciduous as in the permanent dentition. But I would suggest that in the former it is legitimate to restrict the limits of normal variation within narrower bounds and to regard comparatively minor variations as constituting malocclusion. My reason is that usually deciduous malocclusion tends to become accentuated in the permanent dentition, and it is thus important to recognize the significance

of slight irregularities which, trivial in themselves, may become serious in later years.

TYPES OF DECIDUOUS MALOCCLUSION

1. CONTRACTED ARCHES.—Perhaps the most common type of deciduous malocclusion is a general crowding of the arches, chiefly apparent in the incisor region and affecting the mandibular incisors more than the maxillary incisors. The occlusal edges of the incisors should form a symmetrical curve. But in these cases the edges form a zig-zag like a shallow W. The majority of cases are of this slight type, but one may sometimes see more severe cases in which the incisors are definitely imbricated. (Figs. 1, 2.)

2. FAILURE OF SPACING.—Failure to show the spacing in the incisor region which should normally occur at about the age of four, is a common variety of malocclusion. It falls into the second group of those cases which arise subsequently to the development of a dentition which up to that time may be normal. In my experience, when this spacing does not occur, the attrition of the incisors, which I regard as equally a concomitant change in normal jaws, is also absent. I should like to know whether others have also noticed this. Another impression I have gained, though without being in a position to offer any evidence, is that in cases of contracted arches in which there is a positive degree of malocclusion from the commencement, spacing does not occur later, so that the subsequent permanent malocclusion is likely to be severe.

3. ANTEROPOSTERIOR MALOCCLUSION WITH NORMAL MOLAR OCCLUSION (ANGLE'S CLASS I).—Cases of true maxillary protrusion with a normal molar occlusion are not common in the deciduous dentition. It is true that cases which appear to fall into this group are comparatively common, but when we analyze them we find that they are either examples of postnormal occlusion with an associated maxillary protrusion, or that they are associated with open-bite. I have, however, seen a few cases of maxillary protrusion, though without the deep overbite which commonly accompanies the condition in the permanent dentition. A true edge-to-edge bite with neutral molar occlusion may occur, and I have collected some examples. Whether such cases might be transformed into a true maxillary protrusion in the permanent dentition is an interesting point. My own belief is that they do not, and that if we accept a mesial molar occlusion as the criterion of mandibular protrusion, then this form of malocclusion exists as such in both dentitions.

4. ANTEROPOSTERIOR MALOCCLUSION WITH POSTNORMAL OCCLUSION AND MAXILLARY PROTRUSION (ANGLE'S CLASS II, DIVISION 1).—Postnormal occlusion with an associated maxillary protrusion is not uncommon in the deciduous dentition. I have seen a good many examples of a degree comparable to that occurring in the permanent dentition. The clinical features are the same except that it is unusual to find the mandibular incisors biting on the palate. Indeed, there is more often some degree of open-bite. I feel sure that well-marked examples of postnormal occlusion with maxillary protrusion must erupt as such, and that while the condition may become more marked as age advances, yet the mandibular retrusion is present in the predental stage. It is,

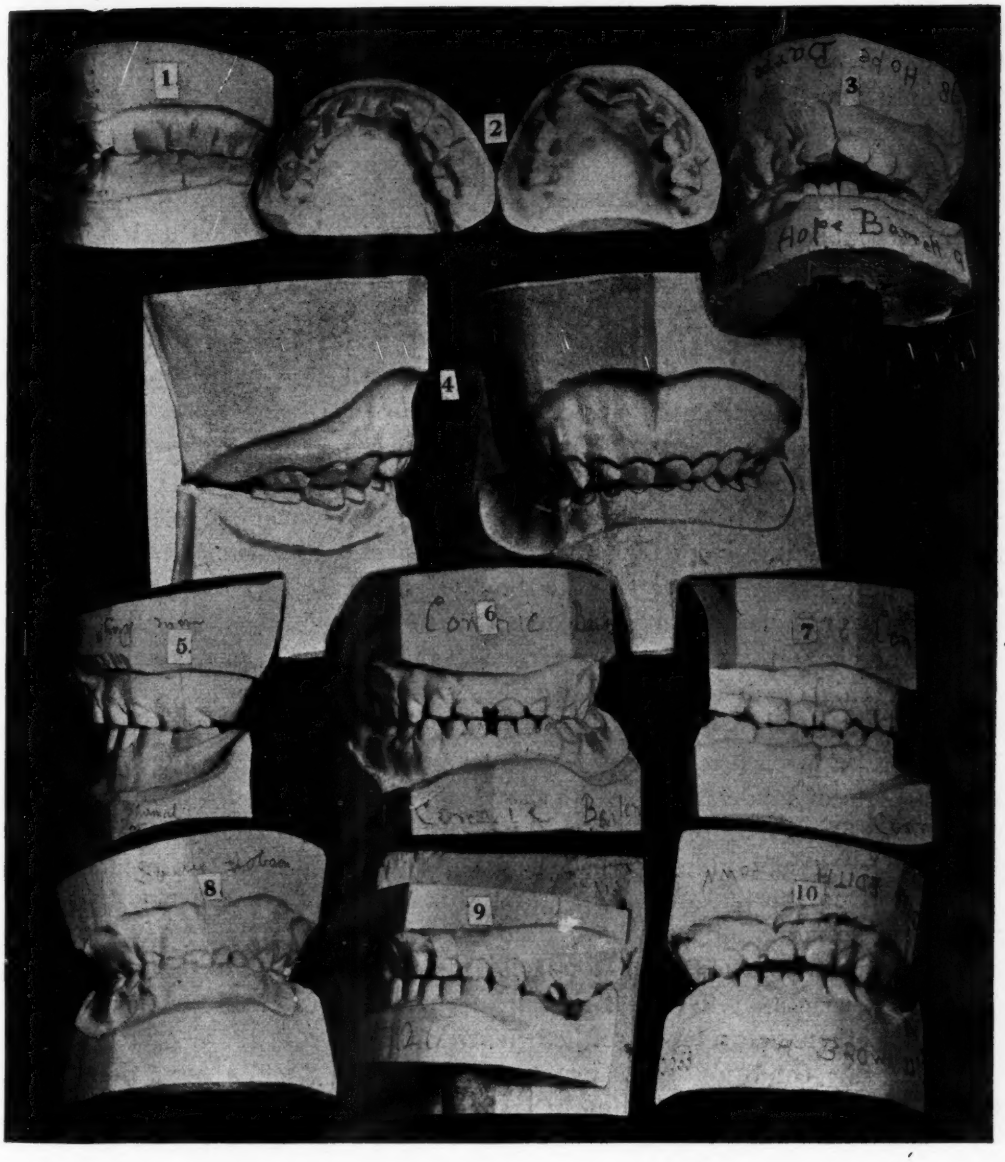


Fig. 1.—Contracted arch, anterior view.
Fig. 2.—Same models, palatal aspect.
Fig. 3.—Postnormal occlusion, Class II, Division 1. History that child was born with prominent jaw.
Fig. 4.—Postnormal occlusion with maxillary retrusion (Class II, Division 2). Girl, aged five years. (By permission of Sir Norman Bennett.)
Fig. 5.—Postnormal occlusion with maxillary and mandibular arches in harmony. Boy, aged six years and two months.
Fig. 6.—Postnormal occlusion with mesioclusion, anterior view. Girl.
Fig. 7.—Same models showing occlusion on right side.
Fig. 8.—Girl, aged eight years, with mesioclusion (Class III). The mother had mandibular protrusion, while the father had a marked degree of postnormal occlusion with maxillary retrusion (Class II, Division 2).
Fig. 9.—A case of cross bite. On closing the mouth, the jaw deviates to the left side.
Fig. 10.—Open-bite. History of tongue-sucking and use of a dummy.

however, difficult to obtain histories bearing on this point. In only one case could I get any reliable evidence. The grandmother who brought the child stated that it was born with a prominent jaw in front. No forceps were used in delivering the child, and so far as I could learn, birth was normal. The child was bottle-fed; a dummy was used up to three months, but the child was not a thumb-sucker. (Fig. 3.) In one case the postnormal occlusion was unilateral, being present on the right side.

5. Anteroposterior Malocclusion: Postnormal Occlusion With Maxillary Retrusion (Angle's Class II, Division 2).—The condition known as Angle's Class II, Division 2, is less common in the permanent dentition than Class II, Division 1, though sufficiently common to be familiar. The clinical picture is unmistakable; the retroclination of the maxillary centrals, the proclination of the maxillary laterals and the deep overbite make up a condition easily recognizable. In the deciduous dentition I regard this type as being the rarest of all forms of malocclusion. In the whole of my experience I have not come across a typical example in the deciduous dentition. But that such cases do exist is evident, for Sir Norman Bennett has shown me the models of a child of five years in which there is postnormal occlusion with retroclination of the centrals. (Fig. 4.) No doubt if this case had been left alone the condition would have become more marked, and would eventually have assumed the characteristic features of this form of malocclusion. The apparent rarity of this condition contrasted with its relative frequency in the permanent dentition, raises some interesting points to which I shall refer later. The nearest approach to a Class II, Division 2 type of which I have any record, are two sets of models. The first shows a postnormal occlusion on the right side only. There is no maxillary protrusion, but there is a deep overbite. The second is even more interesting. The child is six years two months; there is bilateral postnormal occlusion, but the maxillary arch is perfectly proportioned to the mandibular arch, so that there is no incisor irregularity and the arch relationships, though anatomically incorrect, are yet harmonious. (Fig. 5.) I have seen a similar condition in the permanent dentition. I have never seen any other examples in either dentition and, rightly or wrongly, have regarded this condition as being extremely rare. Such a condition as this tends to support the thesis put forward by Sir Norman Bennett, that there may be an evolutionary tendency toward a postnormal occlusion as the normal relationship of the future.

6. Inferior Protrusion With Prenormal Occlusion (Angle's Class III).—True cases of mandibular protrusion in the deciduous dentition are usually thought to be rare. I have, however, collected eight cases. In some the incisor relationship has been edge-to-edge, but the molar occlusion has shown that they were true examples of prenormal occlusion. Beyond noting the existence of this condition in the deciduous dentition there is little more to be said about it, except that it is essentially one of those types of malocclusion which tend to become accentuated in the permanent dentition, and that cases of edge-to-edge bite with mesial molar occlusion will almost certainly become well-marked examples of mandibular protrusion in later life. (Figs. 6, 7, 8.)

7. Malocclusion in the Transverse Plane.—The common form of malocclusion in the transverse plane is a lingual occlusion of the maxillary molars. I have seen several examples of this. In some cases the lingual occlusion has been bilateral, while in others it has been unilateral. The condition may be the only irregularity present; it may be associated with open-bite or it may be part of a general mandibular protrusion; in this latter case the lingual occlusion may be only apparent, for the fault may lie primarily in the mandibular teeth. The unilateral type of lingual occlusion has sometimes been ascribed to pillow habits. I have attempted to obtain corroboration of this, but so far I have signally failed. In one case I thought I had obtained evidence of a pillow habit as the cause of a unilateral lingual occlusion, for the mother stated that the child always went to sleep with the fist doubled up under the cheek. But she also said that sometimes it was the left fist and sometimes the right fist, which did not fit in with a lingual occlusion on one side.

A lingual occlusion of the maxillary molars implies a maxillary arch too small for the mandibular arch. Theoretically, the opposite condition of a maxillary arch too large for the mandibular arch might also occur. I have seen one case which might be regarded as coming into this category: a child of five with what I should regard as an excessive labial occlusion of the maxillary molars associated with spacing of all teeth.

Cross Bite.—Another type of malocclusion in the transverse plane is the condition of cross bite. I have only one record of this, though I am inclined to think that it is less rare than this would indicate, and that I may have overlooked examples. The condition suggests that the bite is one of convenience, either induced by some abnormal position of a tooth which acts as an inclined plane throwing the jaw to one side, or produced by caries, which may lead the child either to avoid a painful tooth or to seek efficient mastication. (Fig. 9.)

8. Malocclusion Occurring in the Vertical Plane.—Malocclusion in the vertical plane may manifest itself as an open-bite or as the opposite condition of close bite or overbite.

Open-Bite.—Open-bite is undoubtedly the most common form of malocclusion in the deciduous dentition, though in the permanent dentition it is relatively rare. Conversely, close bite is more common in the permanent dentition than in the deciduous dentition.

I have seen more examples of open-bite in the deciduous dentition than of any other type of irregularity. Two types can be recognized: (*a*) the anterior open-bite affecting the incisors, which is common, and (*b*) the lateral type affecting the deciduous molars, which is rare.

Anterior open-bite is frequently regarded as being due to habits such as thumb- or tongue-sucking or the use of a dummy. A typical case presents not only a space between the maxillary and mandibular incisors, but also a proclination of the maxillary incisors and a retroclination of the mandibular incisors. Indeed, the abnormality in the anteroposterior plane may be greater than the vertical defect and the actual gap between the cutting edges of the maxillary and mandibular incisors may be relatively slight. While the term open-bite may be justified on clinical grounds, yet the anteroposterior malocclusion should not be forgotten, for it is probable that it is this latter defect

which is perpetuated in the permanent dentition rather than the vertical defect. But cases of open-bite in which the slope of the incisors appears to be normal, so that the malocclusion is entirely in the vertical plane, may occur. (Figs. 10, 11, 12.)

A particularly interesting variant, of which I have collected a few examples, is the coexistence of marked attrition of the incisors with open-bite. How can this be explained? Attrition of a tooth implies an agent causing the attrition. In such cases the mutual occlusion of the maxillary and mandibular incisors is absent, so that this, the normal cause of attrition, cannot be invoked. A habit such as pencil biting might bring about attrition and open-bite, but I have not obtained any evidence of this. In one case of open-bite with attrition there was no history of thumb- or tongue-sucking. (Fig. 13.) With regard to the vexed question of habit in relation to open-bite, I have an open mind, but I am inclined to think that the importance of habit as a causal factor has been overestimated. It would be an easy matter, as my records show, to produce a number of cases of open-bite in which there was a history of a habit, and an equal number of similar cases in which the existence of such habits was strenuously denied by the parents. When a mother specifically states that a child does not suck its thumb, I feel that this statement must be accepted. With regard to the action of the dummy comforter, I would point out that almost all children seen at the hospital suck dummies at some time or other. If the use of the dummy were a cause of open-bite, then this condition should be more common than it is. Perhaps the explanation may be that some other factor in addition to the habit is required in order to bring about the open-bite. But what this *tertium quid* is, if it exists, I do not know.

Lateral Open-Bite.—The lateral type of overbite in which the deciduous molars fail to occlude is less common. All varieties may be met with, from a slight failure of occlusion up to a condition in which the occlusal surfaces of the molars are flush with the gum or even below the gum level. I cannot help thinking that this condition is one which develops subsequently to the eruption of the molars which originally were in occlusion. But I have not been able to observe the development of this condition or to obtain any history bearing on this point. The condition may become cured with the eruption of the premolars, but I should doubt if this always occurs. Perhaps the possibility of cure with the eruption of the premolars depends on the extent of open-bite, and that when the deciduous molars are, as it were, forced into the gum, there is the danger that the permanent molars may tilt forward and oppose a mechanical obstacle to the normal shedding of the deciduous molars. I have seen one or two cases in which this appeared to have happened, with the result that the deciduous molar had become partly buried and the premolar had not been able to erupt. (Figs. 14, 15.)

Close Bite.—Close bite is rare in the deciduous dentition, and the only examples I have seen have been cases of postnormal occlusion already referred to.

9. Miscellaneous Varieties of Malocclusion.—The last class comprises a variety of conditions which though unrelated usually affect individual teeth rather than the whole arch. Clinically they may be of small importance,

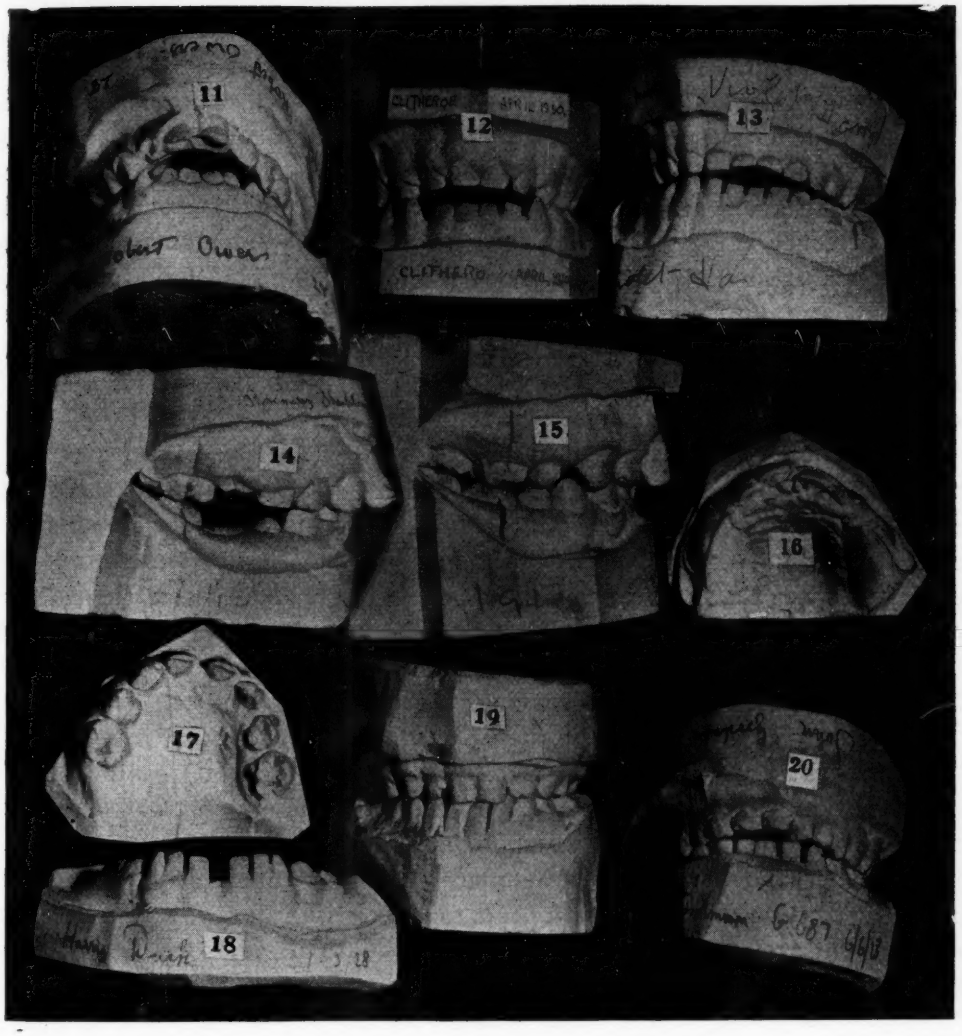


Fig. 11.—Open-bite with maxillary protrusion. Dummy used at night. Mother noticed prominence of jaw as soon as teeth erupted.

Fig. 12.—Open-bite of the parallel type with no proclination of maxillary incisors or retroclination of mandibular incisors.

Fig. 13.—Open-bite with marked attrition of maxillary mandibular incisors. No history of tongue- or thumb-sucking or pencil-biting.

Fig. 14.—Open-bite, lateral type. Girl, aged nine years, showing failure of occlusion of deciduous molars on the right side. The same condition was present on the left side.

Fig. 15.—Same child showing occlusion of premolars three years later.

Fig. 16.—Boy, aged one year, with wide separation of central incisors caused by frenum which has also produced torsion of the right central incisor. Note the abnormal development of the cingula.

Fig. 17.—Congenital absence of $\underline{B \mid B}$, confirmed by radiographs.

Fig. 18.—Gemination of $\overline{C\ B \mid B\ C}$, which has led to wide separation of $\overline{A \mid A}$.

Fig. 19.—Dichotomy of $\underline{\mid B}$; the increased width of this tooth has not led to crowding.

Fig. 20.—Supernumerary tooth present between $\underline{C\ B \mid}$. The arch is displaced forward apparently as a result of the extra tooth.

though not without interest. Separation of the maxillary centrals by a persistent frenum may occur. In one case, in a child of twelve months, the frenum, in addition to producing separation, has also caused some degree of rotation of the right central. (Fig. 16.)

Deficiency in the number of deciduous teeth should be regarded as a form of malocclusion in the strict sense of the word. The deficiency in teeth may be part of a congenital ectodermal defect. In these cases most of the teeth are absent. I have seen two cases of absence of the maxillary laterals which in my experience is rare. In both cases the absence was confirmed by radiographic examination. (Fig. 17.) Whether this was followed by absence of the permanent laterals, I do not know. When a permanent tooth is absent, such as a second premolar, the preceding deciduous tooth is present. May the converse hold good that when a deciduous tooth is absent, its successor may be present? This is a point on which I should like information.

GEMINATION.—Gemination of two incisors or of an incisor and a canine is not uncommon. It may be regarded by some as straining a point to consider such a condition as constituting malocclusion, but it must be remembered that the arch may be correspondingly diminished because the geminated teeth occupy less space than two normal teeth, and that this may lessen the room for the successional teeth. On the other hand, the gemination may not affect bone growth, as in one case in which there was gemination on both sides in the mandible, which had led to unusual spacing. (Fig. 18.)

Dichotomy of a tooth or the presence of a supernumerary may similarly be regarded as a form of malocclusion, though for an opposite reason than that for gemination. In these cases we have an extra amount of tooth substance interpolated in the dental arch which may displace other teeth. It is a curious fact that whereas the presence of a supernumerary in the incisor region of the permanent dentition nearly always leads to severe irregularity, in the deciduous dentition the arch often appears to accommodate itself to the extra tooth. (Fig. 19.) But a careful examination will often show that the extra tooth or the increased width of a tooth which has undergone partial dichotomy is not without its effect. Thus in one case there was some degree of maxillary protrusion which it seemed reasonable to attribute to the supernumerary tooth. (Fig. 20.) In another case the molar occlusion on the side of which there was a supernumerary was postnormal, while on the other side it was neutral.

I now propose to discuss some of the hypothetical or potential relationships between deciduous and permanent malocclusion. In considering the evolution of malocclusion generally it would be helpful if we knew in detail the sequence of events. Are the early symptoms of some particular form of permanent malocclusion always specific, or may they be nonspecific? That is, can a certain type of malocclusion begin in more than one way and conversely, can some form of deciduous malocclusion end in more than one type of permanent malocclusion? Now it is evident that the change from the deciduous to the permanent dentition carries with it the possibility of effecting great changes both of kind and degree on the further evolution of an existing malocclusion, or itself may be able to initiate the development of malocclu-

sion hitherto absent. We might compare this change to a railway junction. Some trains progress from their terminus to their destination without receiving any check at the junction. Others are switched to other tracks; some may stop at the junction, while others may start from there. Thus, to understand a railway system would necessitate a study of what goes on at the junction. Transferring the analogy to the study of malocclusion, we may say that some of the changes which occur are known; some we can surmise with fair accuracy, but there are others of which we are ignorant. It seemed to me that it might be possible to express graphically by the use of symbols the various changes which the translation from the deciduous to the permanent dentition might bring about, and that if the relationships between the two dentitions were put in a form resembling an algebraic equation, it would show the theoretic relationships possible, and in so doing provide a criterion of the extent both of our knowledge and of our ignorance.

Four possible relationships at once suggest themselves.*

(1)

$$o = O$$

where a normal deciduous dentition is followed by a normal permanent dentition. This obviously needs no comment.

(2)

$$o = X.$$

In this case a normal deciduous dentition is followed by malocclusion in the permanent dentition. What evidence is there for this relationship? It is unlikely that it would be true for such forms of malocclusion as post- or pre-normal occlusion, or indeed that any large proportion of cases of permanent malocclusion could be expressed in this way. One obvious example is the malocclusion resulting from the premature loss of the deciduous teeth. But this form of irregularity, though of great practical importance, is of no etiologic interest, for we know only too well how it is produced. Localized displacements of permanent teeth either through some abnormality in their developmental position or because of undue retention of a deciduous predecessor, afford another example. The congenital absence of maxillary laterals or second premolars may lead to shifting in position of other teeth. A tumor pressing on the arches may bring about malocclusion, sometimes of a severe degree. But cases of this kind are either rare or only affect the arches slightly. Of more importance is the question as to whether the generalized types of malocclusion affecting the arches as a whole, can originate in the permanent dentition without some degree of deciduous malocclusion as a precursor.

(3) The third equation would be:

$$x = O$$

where the malocclusion of the deciduous dentition is followed by a normal permanent dentition. At first sight, it might seem that such a relationship is

*The symbols on the left side represent the deciduous dentition and those on the right the permanent dentition. The former are in small type and the latter in capitals.

hypothetical and does not exist in practice. But it may be possible though infrequent. Thus, spacing of the maxillary deciduous centrals may become closed in the permanent dentition by reason of the larger size of the incisors. The lateral type of open-bite, as already shown, may disappear with the eruption of the premolars.

(4) The fourth and most common relationship is represented by:

$$x = X$$

where deciduous malocclusion is followed by permanent malocclusion. This relationship presents several possible variations. The relationship may be a quantitative one and could be expressed as follows:

$$a, b, c, \text{etc.} = A, B, C, \text{etc.}$$

But such an equation would imply that the quantitative relations between the deciduous and permanent malocclusion were the same. Usually, we find that the degree of permanent malocclusion is greater, and the relationship would be more correctly expressed in this way:

$$a, b, c, \text{etc.} = A+, B+, C+, \text{etc.}$$

This is very obvious in prenormal occlusion, in many cases of postnormal occlusion, and in the permanent malocclusion following deciduous contracted arches.

But there is the further possibility of a qualitative change in the character of the deciduous and permanent malocclusion, and the former may be followed by an irregularity of a different type. To revert to the analogy of the railway junction, the train is switched to another route. We know comparatively little about the qualitative changes which are possible at the change from the deciduous to the permanent dentitions. I do not know of any literature dealing specifically with this point, though I imagine that most orthodontists have realized that some types of permanent malocclusion may have existed in a different form in the deciduous dentition. The broad relationship could be expressed in this way:

$$x = Y.$$

I am not in a position to offer any very positive evidence that such a relationship exists, but there are reasons which seem to me to justify its assumption. As already stated, open-bite is very common in the deciduous dentition, but relatively uncommon in the permanent dentition. What has happened? I believe that the explanation is that the type of malocclusion changes. The vertical defect tends to disappear, but the anteroposterior defect is perpetuated, and produces maxillary protrusion with a flattening of the mandibular incisor arch. I have seen this occur in one case, and I believe that if a number of cases of open-bite were followed up (a difficult thing to do in hospital practice), it would be found to occur fairly often. Now let us survey the question from the other end. As I have already said Class II, Division 2, cases in the permanent dentition are not infrequent, but are excessively rare in the deciduous dentition. The permanent malocclusion forms such a distinct clinical

entity that it seems reasonable to suppose that it must have a deciduous precursor equally distinct. I am not in a position to state what that precursor is, and my argument is a theoretical one. If we concede that this hypothesis is at least an arguable proposition, then the relationship between deciduous and permanent malocclusion might be put in more than one form. The relationship, although showing a qualitative difference, might yet be a specific one, and a particular form of deciduous malocclusion might be always or usually followed by a particular form of permanent malocclusion, just as a tadpole always turns into a frog. The relationship could be expressed as follows:

$$a = B,$$

in which there is a specific relationship between the deciduous and permanent malocclusion.

But it might also be possible that the relationship is not always specific, and that a particular type of deciduous malocclusion may be capable of transformation into more than one form of permanent malocclusion; and conversely, a particular type of permanent malocclusion may evolve out of more than one type of deciduous malocclusion. Such hypothetical relationships could be expressed in the following forms:

$$a, b, c, \text{etc.} = D$$

—where a specific type of permanent malocclusion can be preceded by more than one type of deciduous malocclusion; and:

$$a = D, E, F, \text{etc.},$$

where a particular type of deciduous malocclusion can evolve into more than one form of permanent malocclusion.

How far such relationships have a foundation in fact still remains to be proved. I have not been able to follow up a large enough number of cases to prove that these hypothetical relationships do exist. I can only surmise that they are possible, though I hope that I have been able to provide a few indications which suggest that they are not entirely fanciful on my part. I am conscious that my observations have embodied a large amount of speculation and a small amount of fact. Yet speculations have a limited use, and I offer them in the hope that they will stimulate a further study of certain aspects of malocclusion in its early stages which are little known.

DISCUSSION

Mr. George Northcroft wished entirely to endorse all that the President had said about the necessity for the intensive study of malocclusion of the deciduous dentition, especially if members wished to live up to the name of their Society. He thought that the study of orthodontics started with malocclusions of the deciduous teeth, or probably before the eruption of any teeth, and he hoped the address would stimulate the younger members to observe and record by models those anomalies which came under their observation. By the collection of such data he was convinced that the key would at last be found which would open the way to the elucidation of what at present seemed insoluble problems. From his own preliminary observations at a welfare clinic of some hundred children aged from two to five years, he was inclined to think that malocclusion of the deciduous dentition, other than in cases where it was caused by too early loss, was rarer amongst the children of industrials than among

other workers. Contrary to the President's finding, he was of the opinion that close bite in children of the industrial class was more common than the open-bite. He found open-bite rare, and this was interesting because his own observations covered a different region of London to that which figured in the President's investigation. He believed that malocclusion did not necessarily arise in the deciduous dentition. He had shown one case of post-normal occlusion arising from a condition caused by a failure in development in the canine region. It was shown by measurement what was the normal rate of growth in the canine width, and in this particular case the growth in maxillary width had lagged behind the mandibular width, and postnormal occlusion was the result. He thought that the President's symbolic representation of possible permutations and combinations of malocclusion was very happy, and likely to help them all to think clearly, and he hoped that it would be followed up by casual communications on the subject. He thanked the President for a very stimulating address.

Mr. R. Cutler agreed with Mr. Northcroft that the President's address had furnished much food for thought. He had talked widely and comprehensively on a matter which was one of the most important in the specialty. As one's orthodontic experience grew, and one looked back on past cases, he at least became more and more encouraged by the permanence of the results in cases which had been treated early, and more and more discouraged by the lack of stable results in cases which before treatment were relatively mature. That statement defined the gulf between the orthodontist of, say, seven years' standing and the one of twenty-seven years' standing. The younger practitioner, unless he had unique opportunities for specialized practice at a large hospital, had patiently to feel his way along, treating each complication as it arose and not before. The acquirement of perfected technic was easy enough to one who had a flair for manipulative work, and who made or was given opportunities for practice, but this was not enough. It was not the engineer artificer who brought the ship safely into port, it was the captain on the bridge. This logically led to a question with regard to treatment which the President might think not strictly relevant. Having recognized, say in a child of four years, a specific deformity, would he immediately embark upon treatment, or would he wait for the deformity to be perpetuated in the second dentition? To the younger men like himself, a dictum from the President on this point would be very helpful indeed. The last speaker had remarked on the silence of the younger men in discussion, but this silence was very often due to a praiseworthy diffidence and a consciousness of ignorance rather than to any lack of a sense of responsibility or to mental sloth.

Mr. J. H. Badcock took up the President's question as to the cases where the deciduous laterals were absent, and whether their absence was followed by the absence of the permanent laterals. He had a case under his care at the moment where that had happened, and his impression—though it was not more than an impression—was that when deciduous laterals were absent, the permanent laterals were seldom present. Of that, however, he was not sure except in the particular case under his care. One thing the President had said rather astonished him, that he found a much larger number of cases of open-bite than of closed bite in the deciduous dentition. He had no statistics, but in his own private practice he could say that a close bite was far commoner than an open-bite in the deciduous dentition, and that it was probably the commonest of the malocclusions he had come across.

Sir Norman Bennett: With a normal occlusion or a postnormal?

Mr. Badcock replied that this was with a normal occlusion. The President had also raised the question whether a malocclusion in the deciduous teeth might result in a good occlusion in the permanent teeth. He thought that in certain cases it might and did. Take the case of open-bite which was caused by the use of "the comforter" or sucking the thumb. There was no doubt whatever that that deformity did disappear in the deciduous teeth after the habit had been given up—in other words, that it was purely mechanical. He thought—though here again he was not sure—that retroversion of the maxillary centrals might disappear in the permanent dentition, as also lingual occlusion of the molars. He thought that when these conditions occurred in the deciduous dentition they were not necessarily followed by the same irregularity of the permanent teeth. With regard to Class II, Division 2, the President had questioned whether that irregularity was perpetuated in the permanent dentition. He thought

that what decided the difference between Division 1 and Division 2 was what he might call the accidental position of the lower lip, and that that really was the entire determining factor. He had a case which he had shown to the Society where the condition on the one side was that of Division 1, and the condition on the other side was that of Division 2. He thought it was just a matter of chance, and due to the length of the lower lip. It was this which determined whether a Class II case became Division 1 or Division 2 in the permanent dentition.

Mr. H. C. Visick remarked that the President in his paper had said, that "whereas the presence of supernumerary teeth in the incisor region in the permanent dentition nearly always led to irregularity, in the deciduous dentition they seemed to accommodate themselves to the position." Mr. Visick suggested the explanation was that the arch in the deciduous dentition was made of teeth and spaces, and if one had an extra tooth, or extra wide teeth, it simply meant that the spaces were encroached upon, and no irregularity of the teeth occurred. The President had said he found that the Class II, Division 2 cases were very rare in the deciduous dentition, but they were not infrequent in the permanent dentition. For his own part he saw a quite obvious reason for that. The Class II, Division 2 case was really a Class II, Division 1 case in process of correcting itself by alteration of habit. The Class II, Division 1 case was nearly always associated with mouth breathing, whereas in a Class II, Division 2 case the patient was nearly always a normal breather. The Division 1 case in a deciduous dentition occurred in a child who was a mouth breather; later on he became a normal breather, and the lips closed, but the molar relationship had been upset, and that was not cured by an alteration in the mouth breathing, so that some irregularity remained. During the years of deciduous dentition there was not time for a change from a Division 1 to a Division 2 arrangement to take place, but the change did take place after the stage of the deciduous teeth. The change of habit having taken place in the breathing, as the permanent teeth erupted they became double-backed under pressure of the lip.

Mr. H. E. Marsh wished to describe to the Society the condition of a family with which he was well acquainted. The family consisted of three boys. Their deciduous dentitions were all Class II, Division 2. The oldest boy was a mouth breather and had a very short upper lip. His present condition was Class II, Division 1; he was now sixteen years of age. The second boy was not a mouth breather; his present condition was neutroclusion on the right side and postnormal occlusion on the left; his age was eleven years. In the third boy the present condition was that of normal occlusion so far as the molars were concerned, but the speaker thought he would probably display some excessive over bite in the front and slightly protruding maxillary lateral incisors.

Mr. Bulleid said that there was one factor which might have been emphasized a little more, namely, the difference in the class of children in relation to the difference of malocclusion in the deciduous dentition. In the cases the President had brought forward he had stated that open-bite was the commonest condition in the deciduous dentition. These were children of the hospital class. But in private practice the close bite was by far the most common deformity in the deciduous dentition. He supposed that the explanation was that in the hospital class of children bad habits were commoner, and the "dummy" was invariably used, whereas in a better class of society better habits prevailed. He thought there was a good deal to be got from the discussion of a point like that, and, of course, there was so much of importance in separating and correlating the endogenous and exogenous factors in the production of malocclusion, that altogether he thought this address deserved a separate evening for discussion, after members had had a chance to read it. It would certainly not be adequately discussed that night, as so many points of controversy and interest had been raised. Perhaps Mr. Northcroft would start the next discussion by repeating his remarks made this evening.

Miss K. C. Smyth showed some models through the lantern illustrating close bite. In two of these cases, a brother and sister, the close bite was definitely hereditary, the mother having an excessively close bite. The permanent incisors of the sister had erupted when the models were taken, and the left central was badly rotated. The brother's models showed close bite of the deciduous incisors without other irregularity, but later this boy erupted his left

maxillary central incisor in exactly the same position as his sister's. Miss Smyth showed other models with interesting degrees of close bite in the deciduous dentition.

Mrs. Lindsay said that even those who had not previously known the President, if they read this paper, would see at once that he had the pen of a ready writer directed by a well-stored mind. He had stated at the end that he had not given many facts, but no one whose experience was not very extensive, could have written such a paper or have given so much pleasure to an appreciative reader. The paper was packed so full of detail that she agreed with Mr. Bulleid that there ought to be another opportunity of discussing it more fully. There were one or two points which she desired to pick out. On the question of mandibular protrusion, she had the privilege once of seeing a small child of nine months, and the mother requested her to feel the child's teeth while the child was asleep. The mouth was closely shut, and the four mandibular incisors were locked in front of the maxillary incisors. Later on the child developed a perfectly normal occlusion when the molars erupted. She had noticed often in a child of that age, when the deciduous molars were coming through, the mandible was invariably pushed forward. At birth the mandible was always in retrusion, and Dr. Robin, of Paris, had taken up the point and had suggested that most bottle-fed children had mandibular retrusion because they had no encouragement to put forward the mandible. Moreover, they were generally lying on their backs, and the mandible was falling backward. The President had spoken of the frenum separating the maxillary incisors. Cecil Tait, in New Zealand, had shown that the frenum was not a cause of the separation of the incisors, that the spaced maxillary centrals were a definite type of dentition, and that it was a very questionable thing whether they should be approximated unless the space on either side could be filled. If the laterals, for instance, were out of position, and were brought into line so closely against the incisors that they kept them in position, or if there was a permanent retention plate, then this procedure might be followed. She once had a very rare specimen of a central lateral and canine in the deciduous dentition geminating on both sides. She was very sorry to say that she had parted with the specimen many years ago, and did not know what had become of it, but she thought it a very rare condition.

Mr. Maxwell Stephens said that with regard to mandibular protrusion, the jaw might go forward sometimes if there was a tendency to lack of development in the maxilla. If it went forward like that, and remained forward too long, and the molars did not come through, the maxillary teeth might slip inside the molars and spread them.

Mr. Harold Chapman thought that the President's address would become a classic, and therefore it was with the more temerity that he suggested for consideration that instead of classifying the first series as 1, 2 and 3, the President should make 1 and 2 into one group, "general causes," and 3 into a second group, "local causes," the former could then be subdivided into prenatal and postnatal groups, and also parturient if thought advantageous. He merely suggested that as probably increasing the value of the classification. He did not quite agree with what the President had said about the early stages of Class II cases. Mr. Visick had said that the deciduous arches consisted of teeth and spaces, and so, in a Class II, Division 2 case, if one has the teeth in alignment but no spaces, the deciduous arch is already too small and if there is any crowding of the deciduous teeth the "smallness" is greater still, and as there are no spaces in the permanent dentition, it followed that there must be considerable crowding of the permanent teeth which in Class II, Division 2 cases is expressed in the form of protrusion of the maxillary laterals. Such prominence of the maxillary deciduous laterals would be an extreme case of Class II, Division 2 in the permanent dentition. He wished to ask the President whether it was his opinion that some of the cases of deciduous dentitions, without spaces, had originally had spaces between the teeth or whether they had always been in contact as shown by the lantern slides. Mr. Chapman showed through the lantern some models of his own cases, and went on to say that when the President stated that the crowding was greater in the mandibular arch than in the maxillary he could only conclude that this was on account of excessive over bite. Like some of those who had already spoken, he did not regard Class II, Division 2 cases as being the rarest in the deciduous dentition; but, as already explained, they have not usually the same appearance in the latter as they have in the permanent dentition. He agreed with those members who had said

that the open-bite, referred to in the paper, was due purely to a local cause, and as soon as that cause was removed, the condition corrected itself. With regard to the depressed deciduous molars as the cause of open-bite in the molar region of the deciduous teeth, he did not personally regard the condition shown as one cause of open-bite, but rather as a normal developmental condition which seemed to occur in some cases. He had a case at the present time of a child of about seven in which one of the first deciduous maxillary molars had not erupted at all; one cusp could just be seen; this was the only case he had seen of that character.

Sir Norman Bennett spoke with regard to the cases of protrusion and proclination of the maxillary incisors with a normal bite. The President had quite rightly pointed out that although that was not so very uncommon in the permanent dentition, it did not occur in the deciduous dentition with anything like the same frequency. The speaker thought that the explanation of that was that, partly, there was not time for it, and partly, that the natural tendency with the deciduous dentition from the earliest years onward was for the gradual production of an edge-to-edge bite. With regard to Class II, Division 2 cases, two or three of the examples shown by Miss Smyth suggested to his mind that they were precursors of the Class II, Division 2 case, even if they could not be described in those terms. He believed that it was the same condition, but there was not the proclination of the laterals. With regard to the difference between Class II, Division 1 and Class II, Division 2, he was not sure whether he agreed with Mr. Badcock. For years he had been teaching what Mr. Badcock had said, but he had never quite believed it! Nor did he quite agree with what Mr. Visick had said, though he did not know what the explanation might be. He believed there was some fundamental difference between Class II, Division 1 and Class II, Division 2; he did not think it was only a question of the position of the maxillary incisors. There was a difference also in the jaw formation. In the Class II, Division 2 case one often got a narrow parallel-sided arch, and in the Class II, Division 1 case one did not so often get that. The case the President had shown as an example of Class II, Division 2 of the deciduous dentition happened to be a case with which he himself had had a good deal to do. In this particular case, when the child was five years of age, he started treating the deciduous dentition with intermaxillary traction in the hope that by treating the deciduous teeth the permanent teeth would come into their proper positions, and the occlusion be right also. He was woefully disappointed. He did achieve a certain result with the deciduous teeth, and this continued with the permanent dentition, and he got the occlusion right. He left retention on for a long time, and thought everything was well, but on taking it off, the condition went back on one side only. He got that side right, and then the other side went back. In the end he got what he thought was a tolerable result; the bite was normal on one side and nearly normal on the other, but there was a malposition of a maxillary lateral incisor. That was an example of what often happened with treatment of the really difficult cases of this kind. He considered of all the cases of malocclusion that had to be treated on idealistic lines, the cases of Class II, Division 2 were among the most difficult. If he might summon up courage to criticize so eminent a comparative anatomist as Mr. Pitts on the subject of the tadpole, he would take exception to Mr. Pitts' analogy. Mr. Pitts had said that just as the tadpole turned into the frog so the deciduous dentition inevitably turned into a particular form of permanent dentition. But the fact was that the tadpole might turn out to be a frog or a toad, and therefore it followed that Mr. Pitts' analogy was false. If he might take up the same analogy—for he would be sorry if it were lost altogether—he would suggest that it be cited as an example of the fact that one did not know what would happen from malocclusion in the deciduous dentition. It might turn into one or another—it might be either a toad or a frog!

Mr. Herson said that as a visitor and a young member of the profession, he felt he must say something on behalf of those he might be said to represent. Surely, after Sir Norman Bennett's amusing remarks, it must be realized that it was very difficult for a youngster to stand up and make remarks at such a meeting. He wanted to express thanks to the President for this enlightening paper, from which he had learned many things which he had not learned as a student, and those he had learned as a student, Sir Norman Bennett had just suggested might not be true!

Mr. Cale Matthews congratulated the President sincerely on the originality of his address. He himself had advanced some of the possible causes of malocclusion in one or two papers which he had read, and those causes had been particularly stressed by the President that evening. Mr. Northcroft, who had opened the discussion, was the chairman of a committee formed in the Society some years ago which, after a great deal of hard work, issued a report expressing the desire that orthodontic nomenclature should be of a certain character as there set forth. But the speaker had been deeply impressed that evening by the fact that every one who had taken part in the discussion had ignored that new terminology and reverted to the old classification. He wondered whether orthodontists were becoming retrogressive. He thought it would be well to decide here and now which nomenclature was to be adopted. With regard to the President's address, he hoped that there would be other opportunities for discussing it, because it contained sufficient material to afford scope for further discussions, and even for other papers, either during the present session or in the future. In particular it would be interesting to hear from those members who had had the opportunity of attending clinics and welfare centers and following up the work from the eruption of the deciduous dentition until the sixth or seventh year. That was an opportunity that the general practitioner and the exclusive orthodontist very rarely obtained. A fund of information would be acquired in that way which could not be forthcoming in any other.

The President, in replying on the discussion, said that first of all he thanked the members for the complimentary way in which they had discussed his paper. He was gratified to find that he had thrown a stone into the water which had caused so many ripples. It was very obvious that on a subject like this, one could not make statements which would be accepted by every one. One of the things that had interested him was the number of members who had said that contrary to his own experience, they had found close bite more common than the open-bite. As he had said, the experiences recorded in the paper were based on hospital cases, and he did adumbrate the possibility that a grading of malocclusion on a social basis might reveal some differences. He instanced the open-bite condition as one that might be affected, and thought it probable that cases taken from private practice would show a far smaller incidence of open-bite, in contrast to the children in hospital practice. Those concerned in private practice could bring to the subject certain points of view which others dependent on hospital experience had not always the opportunity of gaining. In private practice the cases could be studied more leisurely, but all his work had to be sandwiched in with the actual treatment of the children. He would like to take this opportunity of expressing his sincere appreciation of the arduous and self-sacrificing labors of his clinical assistants who had assisted him for many years. One of the interesting points raised had been with regard to Class II, Division 2. After all, Angle's classification was merely a kind of international language, used very much in the same way as learned people corresponded in the Middle Ages in Latin. It did not necessarily imply an acceptance of Angle's views. What might be called Class II, Division 2 cases presented one of the most puzzling problems in orthodontics. It was obvious that a great deal of work on this question had yet to be done. He still thought that the explanations put forward by different members were not really so simple as they appeared. Mr. Chapman had raised an interesting point about spacing. When one had a case like that which he had shown, with an unusual degree of spacing, he thought probably that such spacing had always been present. But one of the difficulties of hospital practice was that after seeing a case of the kind, one might never see it again. What had been borne in upon him was that even attendance at a children's hospital was not enough for the purpose of studying orthodontics; one wanted to go to an infant's clinic and watch the children during their first year of life. Mr. Chapman had mentioned a case of failure of eruption of a deciduous molar. He too, had had one case of that kind; there was apparently no reason for the noneruption of a right mandibular deciduous molar. Gradually a cystic condition formed, and he had to remove the tooth.

THE REGULATION OF MALOCCLUSIONS*

By Bernard L. Hyams, D.D.S., Montreal, Canada

IN THIS work, the methods I employ for the regulation of the common malocclusions are described, together with the principles that underlie their use.

The first matter to receive consideration is to treat on the standards of compatibility and efficiency that govern the use of orthodontic appliances. These principles I have previously expounded in two papers, "The Application of Force as a Therapeutic Measure for the Correction of Malocclusions,"[1] and "A Consideration of Attachment."[2] In summary, the important principles are as follows:

FACTORS OF COMPATIBILITY

1. The use of any device that induces pathologic changes is interdicted. Ketcham has conclusively shown that fixed attachments and bodily tooth movement are liable to cause apical resorption of the roots, particularly of the maxillary incisors, to a much greater extent than do other types of appliances. To the conscientious operator this is an injunction to discard the appliances of the pin and tube and ribbon arch variety. Lundstrom in addition has cast doubt on the efficacy of bodily tooth movement for the production of basic osseous growth to a greater degree than simple tooth movement.

2. Appliances must be constructed along lines that reduce to the minimum the danger of causing caries. The easy removal of appliances by the patient is very advantageous on the grounds of prophylaxis. Fixed appliances on the other hand enable the operator to retain sole control of regulation, an important matter with many patients who do not cooperate with the operator. In using fixed appliances, it becomes an important matter to protect the labial and buccal surfaces of the teeth from the risk of caries due to the lodgment of food débris against the appliances. This is often provided by bands set for this purpose.

3. Bands must be contoured to avoid encroachment on the gingival tissues, to prevent trauma and irritation, and appliances must be so constructed and finished that they do not irritate the lips, cheeks and tongue.

4. The materials employed in the make-up of appliances should have such properties that they do not cause injury to the mouth. This calls for the use of precious metals, the very best quality of cementing materials, and the frequent changing of rubber and silk ligatures.

5. The type of artificial force exerted by an appliance should be of a gentle constant nature, that is just sufficient to stimulate cell activity. It has also been pointed out that a minute adjustment of a powerful initial force,

*Paper presented before the American Board of Orthodontia.

such as screw force, is rendered compatible by the inherent elasticity of the alveolar tissues.

6. The employment of muscle training either as an active agent or as an adjunct of treatment is indicated.

EFFICIENCY FACTORS

1. Appliances in general should be so designed that they are fairly easily constructed in the first instance, easily removed and replaced for adjustments, and easily manipulated.

2. Bands and attachments should be so located that they are free of the forces of occlusion, with the exception of bite plates and obstructors, which depend on interference with the occlusion for their effectiveness.

To suit the particular requirements of individual cases many modifications are often required from the ideal plan, and careful consideration must be paid to the face, particularly in the stage between the diagnosis of a condition and its treatment. In this work it has therefore been found advisable to consider appliances for the movement of teeth and the development of bone in various directions, rather than for the correction of the three classes of malocclusions with their divisions and types. Appliances are accordingly presented for the purpose of stimulating lateral development, vertical development, for correcting open-bite and excessive overbite, for anterior development of the maxillary arch and of the mandibular arch, for retracting the maxillary anteriors and retracting the mandibular arch, for correcting the various malpositions of individual teeth; and in the field of muscle training attention is directed to the alterations of the muscular environment of the denture by exercises for the improvement of the development of atonic lips, removing interference through the interposition of the lower lip between the dental arches, correcting mouth breathing and the development of the mandible by muscle exercises. The problem of retention will also receive some consideration.

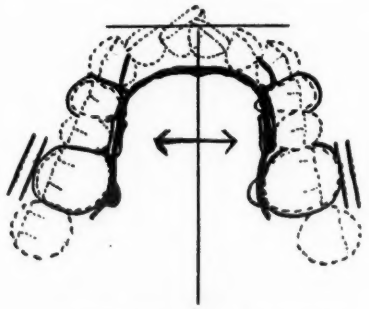
The general principle governing the design of my appliances is to separate the various deviations that constitute a malocclusion as expounded in my article, "Physiologic Diagnosis: A Key to the Regulation of Complex Malocclusions,"[3] to develop an effective appliance for the correction of each deviation, and then to combine the separate appliances in order to be able to treat as many defects simultaneously as will permit. In this way the active period of regulation is reduced to the shortest possible time, and it is often possible to overlap the retention of one deviation over the regulation of a more resistant one, thereby reducing the entire period of treatment to the minimum for each case.

LATERAL DEVELOPMENT

The Mershon lingual arch with delicate finger springs and loosely fitting half-round locks is generally used to stimulate lateral development. The occurrence of apical root resorption of molars with this attachment is rare in my practice. Bands with lingual loops are placed on the maxillary first premolars to assure stability against the stresses of mastication. Fig. 1 illustrates the appliances for lateral development of both arches.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



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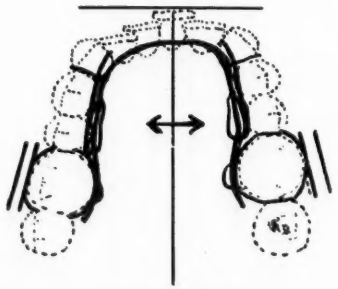
MANDIBULAR APPLIANCE



LEFT RIGHT

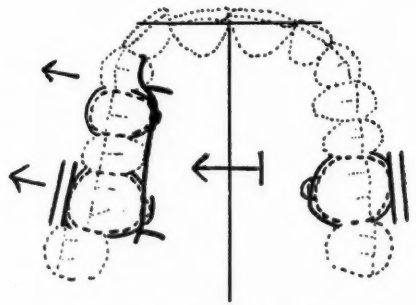
PROCEDURE

TO CORRECT LATERAL UNDERDEVELOPMENT ONLY.

Fig. 1.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*.

MAXILLARY APPLIANCE



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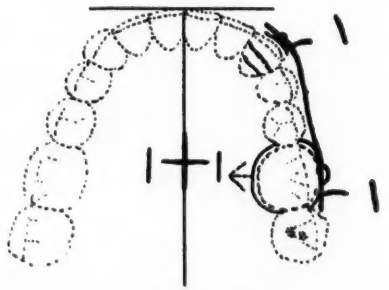
MANDIBULAR APPLIANCE



LEFT RIGHT

PROCEDURE

TO CORRECT 6 5 4 3 LINGUOVERSION.

Fig. 2.

UNILATERAL LATERAL DEVELOPMENT OF THE MAXILLARY ARCH

My experience with other appliances has led me to adopt the use of intermaxillary reinforcement as a routine procedure for the correction of unilateral lateral underdevelopment of the maxillary arch.

The maxillary first premolar and molar on the faulty side and the mandibular canine and first molar are banded. The maxillary teeth are joined by a lingual extension and the mandibulars by a buccal extension. Hooks are soldered to both extensions at their extremities for intermaxillary elastics.

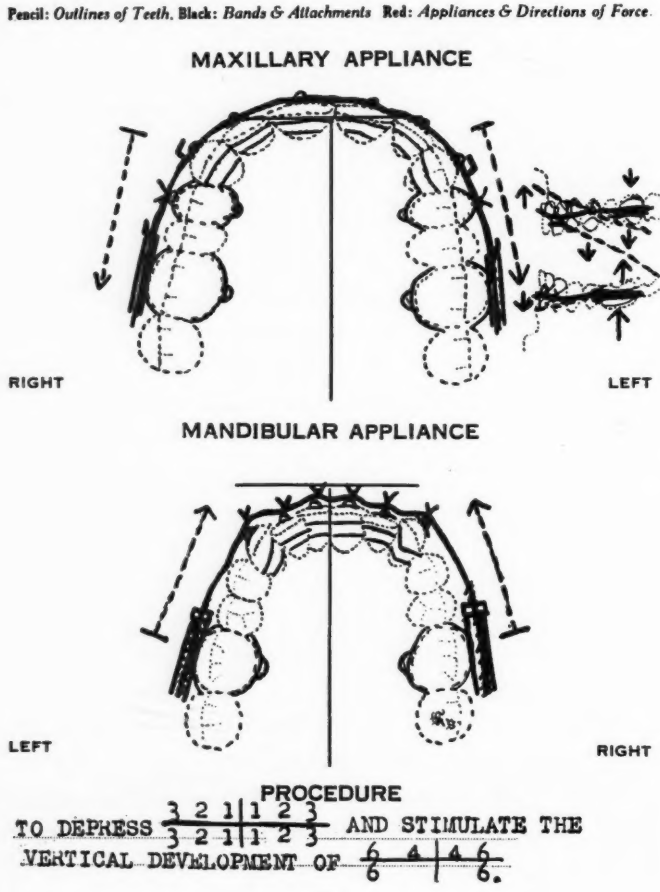

Pencil: Outlines of Teeth. Black: Bands & Attachments Red: Appliances & Directions of Force.
MAXILLARY APPLIANCE
RIGHT
LEFT
MANDIBULAR APPLIANCE
LEFT
RIGHT
PROCEDURE
TO DEPRESS 3 2 1 | 1 2 3 / 3 2 1 | 1 2 3 AND STIMULATE THE
VERTICAL DEVELOPMENT OF 6 4 | 4 6 / 6 | 6.

Fig. 3.

When other appliances are required, the principle is incorporated into the maxillary lingual arch and the mandibular labial arch, Fig. 2.

VERTICAL DEVELOPMENT

1. *Closed Bite.*—In cases that exhibit an excessive overbite, it is likely that this condition is due to a combination of vertical underdevelopment in the molar region and overeruption of the anteriors. The problem practically, is to reduce the extent of the overbite. The principle followed is to employ a reciprocal appliance that exerts an elevating force on the molars and a depressing force on the anteriors. Intermaxillary anchorage is employed in conjunction with this appliance, the appliance being carefully adjusted to counteract the tendency of

the elastics to elevate the maxillary incisors. If no attachment is made to the anteriors, but to the first premolars instead, this is avoided, and at the same time the curve of Spee is improved, Fig. 3.

2. *Open Bite.*—Following a check of the length of the face, anterior intermaxillary elastics are used to elevate the anterior teeth if the general height of the face is correct, or intermaxillary elastics, reciprocal force and masseter and pterygoid exercises combined are used where it is hoped to depress the molars, correct the angle of the mandible or improve the development of the ramus. The attachment to the anterior teeth varies with the requirements of the labial arches. In Fig. 4, the attachment is secured by a horizontal extension gingival to the tube, which acts solely as a cleat. The labial arch in this case is ligated to the molars. Where the anterior movement of the incisors is called for, as in Fig. 5, the labial arches are ligated, and threaded end sections are brought into use.

ANTERIOR DEVELOPMENT OF THE MANDIBULAR ARCH

1. *To develop the entire mandibular arch anteriorly,* a plain lingual arch and buccal hooks on the molars are used with intermaxillary elastics, in conjunction with a labial appliance on the maxillary arch. When the overbite is normal, long intermaxillary hooks are soldered to the labial arch to eliminate a vertical pull of the elastics. With a careful patient the labial arch may be removed for prophylaxis several times a day; otherwise it is ligated to the molar bands, Figs. 6 and 7.

2. If an excessive overbite is associated with this condition, bands are cemented on the maxillary first premolars with buccal tubes. These tubes are engaged by gingival extensions from the labial arch as shown in Fig. 7, and by the action of intermaxillary elastics the premolars tend to become elevated, thereby accentuating the curve of Spee and accordingly improving the overbite. Bands with labial tubes are also placed on the mandibular anteriors, and the mandibular labial arch is adjusted reciprocally with the object of depressing the mandibular anteriors and elevating the mandibular molars. This also acts to reduce the overbite.

3. *To develop the anterior region of the mandibular arch,* the mandibular anteriors are banded and vertical short tubes soldered labially. A lingual arch with half-round locks is adapted, and extensions are soldered running to the mesial surfaces of the first premolars to stabilize the molars and employ all available anchorage. The six anteriors are ligated to a labial arch with threaded ends and anterior spurs. The appliances are adjusted by tightening the nuts and ligatures periodically, Fig. 8. If additional anchorage is desired, intermaxillary anchorage can also be employed as in Fig. 9. To correct an excessive overbite intermaxillary anchorage is employed in conjunction with a reciprocal adjustment of the labial arch, Fig. 9.

ANTERIOR DEVELOPMENT OF THE ANTERIOR REGION OF THE MAXILLARY ARCH

The maxillary anteriors are banded and short vertical tubes soldered labially. These are ligated to a labial arch with threaded ends and spurs as in Fig. 10. A lingual arch with premolar extensions is always used to employ

Pencil: *Outlines of Teeth*. Black: *Bands & Attachments* Red: *Appliances & Directions of Force*.

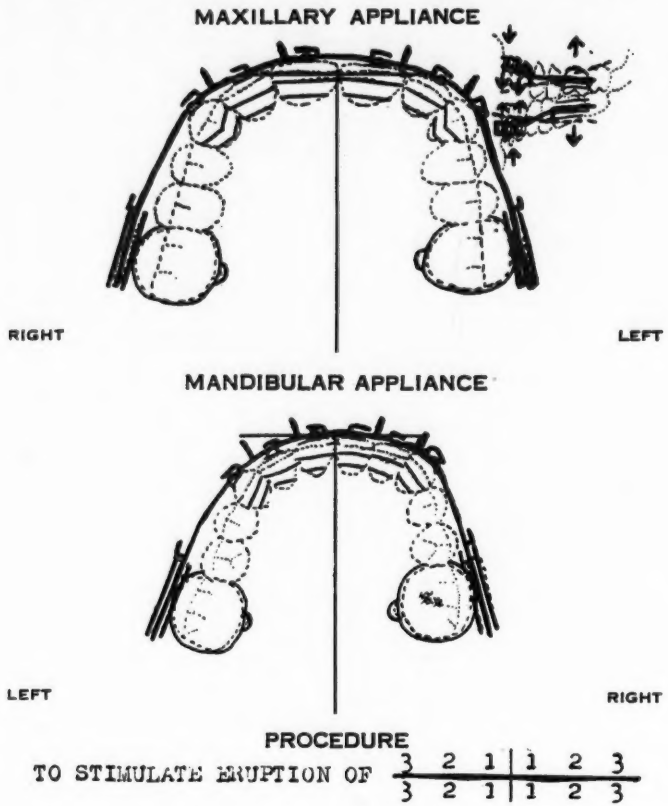


Fig. 4.

Pencil: *Outlines of Teeth*. Black: *Bands & Attachments* Red: *Appliances & Directions of Force*.

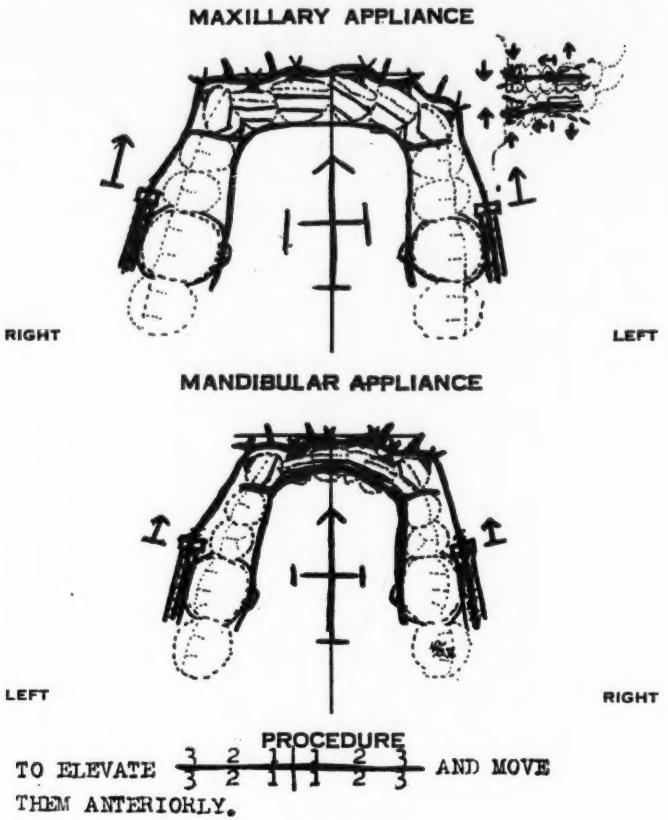


Fig. 5.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

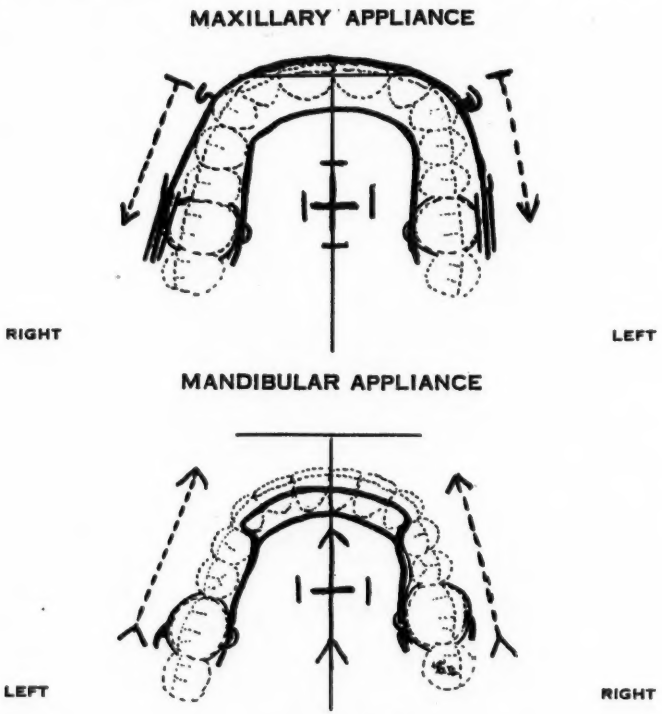


Fig. 6.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

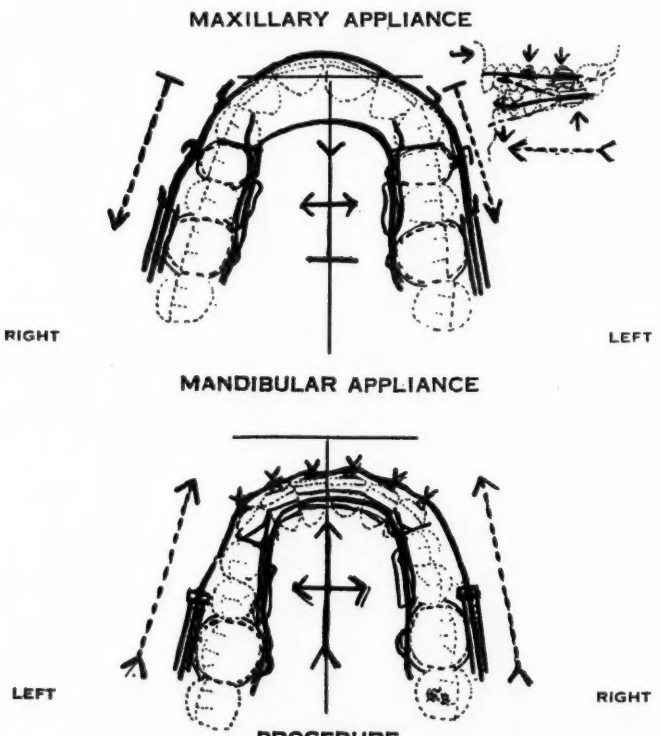
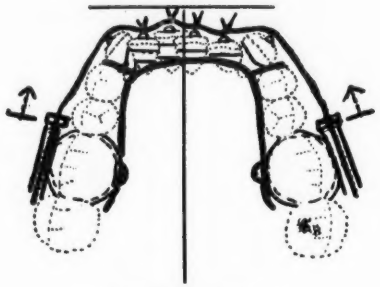


Fig. 7.

MANDIBULAR APPLIANCE



LEFT RIGHT

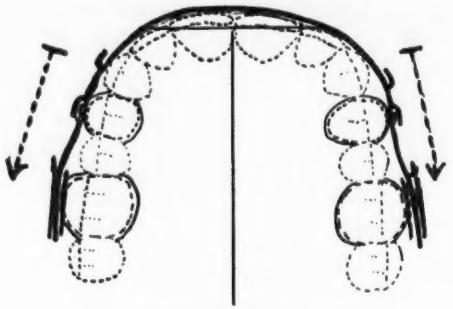
PROCEDURE

TO MOVE $\frac{2\ 1}{1\ 2}$ ANTERIORLY & ALIGN THEM.

Fig. 8.

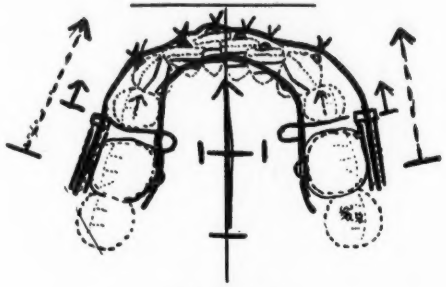
Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

MANDIBULAR APPLIANCE



LEFT RIGHT

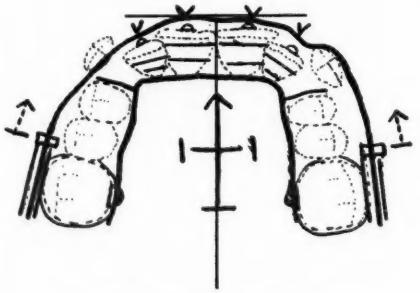
PROCEDURE

TO MOVE $\frac{3\ 2\ 1}{1\ 2\ 3}$ ANTERIORLY, IMPROVE THE OVERBITE, AND ALIGN $\frac{5}{5}$.

Fig. 9.

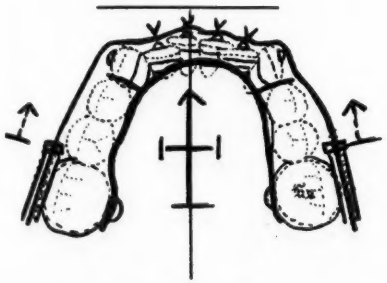
Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

MANDIBULAR APPLIANCE



LEFT RIGHT

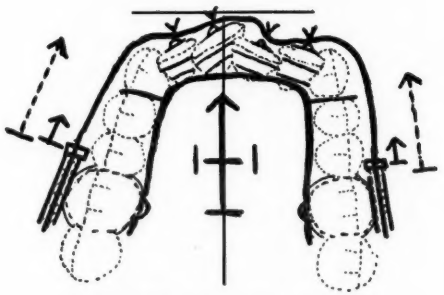
PROCEDURE

TO MOVE $\frac{2\ 1\ |\ 1\ 2}{2\ 1\ |\ 1\ 2}$ ANTERIORLY.

Fig. 10.

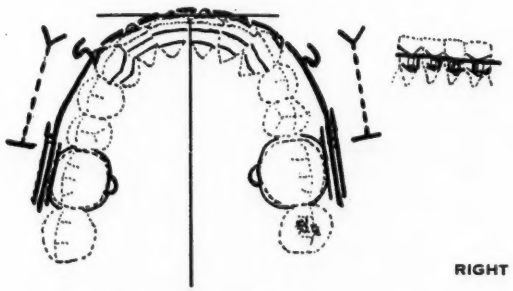
Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

MANDIBULAR APPLIANCE



LEFT RIGHT

PROCEDURE

TO MOVE 2 1 1 2 ANTERIORLY.

Fig. 11.

all available anchorage. When the maxillary anteriors are lingually placed to the mandibulars, Fig. 11, intermaxillary anchorage is made use of as a desirable reinforcement of the molars.

TO RETRACT THE MAXILLARY ANTERIORS

The maxillary anteriors are banded and labial tubes soldered. A labial arch is adapted to rest occlusally to the tubes, and to run freely through horizontal tubes soldered to the buccal surfaces of the molars, as in Fig. 12. Horizontal extensions are then soldered to the arch to rest gingivally to the vertical tubes. These permit free lateral movement of the banded anteriors. Intermaxillary anchorage is employed to retract the maxillary anteriors. If the overbite is correct, long hooks are used to avoid vertical traction. If an excessive overbite exists, the arches and elastics are manipulated to reduce the overbite. The interposition of the lower lip and an atonic upper lip are frequently associated with this condition. Steps are taken at the outset of treatment to discontinue the lip habit and to develop the lips to their proper tone by muscle exercises.

TO RETRACT THE MANDIBULAR ARCH

The six maxillary and mandibular anteriors are banded and vertical labial tubes soldered. The mandibular labial arch is adapted to rest occlusally to the anterior tubes, and small hooks are soldered just in front of the molar tubes to bear on the molars and ligate the arch, as in Fig. 13. Horizontal extensions are soldered for the anteriors to stabilize the arch and at the same time to permit ample free movement of the teeth.

The maxillary labial arch is adapted to rest in the center of the tubes, and the maxillary anteriors are ligated to this arch. A plain lingual arch is inserted to stabilize the maxillary molars. Intermaxillary anchorage is depended on to retract the mandibular arch. If this does not prove effective, occipital anchorage is used. A tightly fitting mesh head cap is worn as much as possible, and a traction bar is attached to the cleat on the mandibular labial arch shown in Fig. 13.

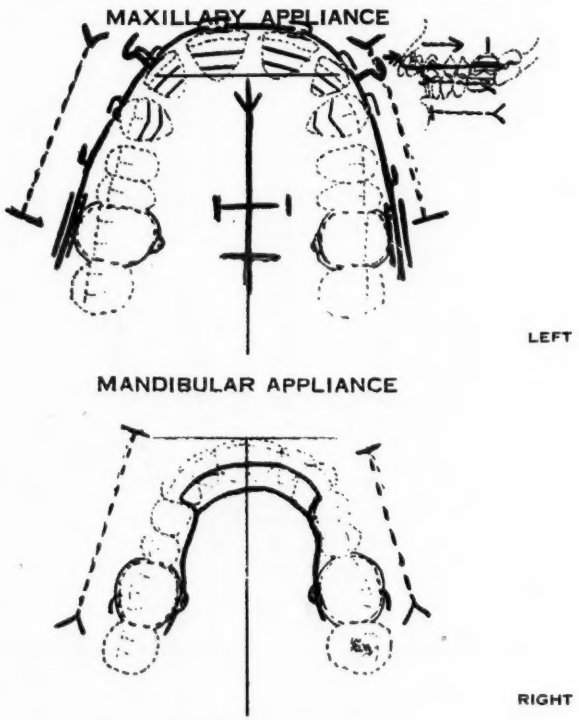
THE REGULATION OF MALPOSED TEETH

Rotations.—To correct mild rotations of the maxillary incisors, 24 gauge finger springs soldered to labial and lingual arches, and adjusted in conjunction, are very effective, and at the same time less liable to cause apical damage than any other device. Fig. 14 illustrates the action of the appliances.

For marked rotation of the incisors, canines and premolars, the teeth are banded and labial or buccal tubes and lingual spur loops soldered. Very fine stainless steel ligature wire is twisted to a cable and periodically tightened until the tooth is in position. Fig. 15 describes the appliance and the adjustment. Occasionally a finger spring with a loop end is soldered to the body wire, and the ligature tied to this finger spring instead of direct to the arch. This provides an excellent type of force, and an extensive adjustment.

To rotate molars mesiobuccally, the Dewey lock is very effective. The lock is adjusted to bear against the mesiolingual angle of the molar, as shown in

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*.

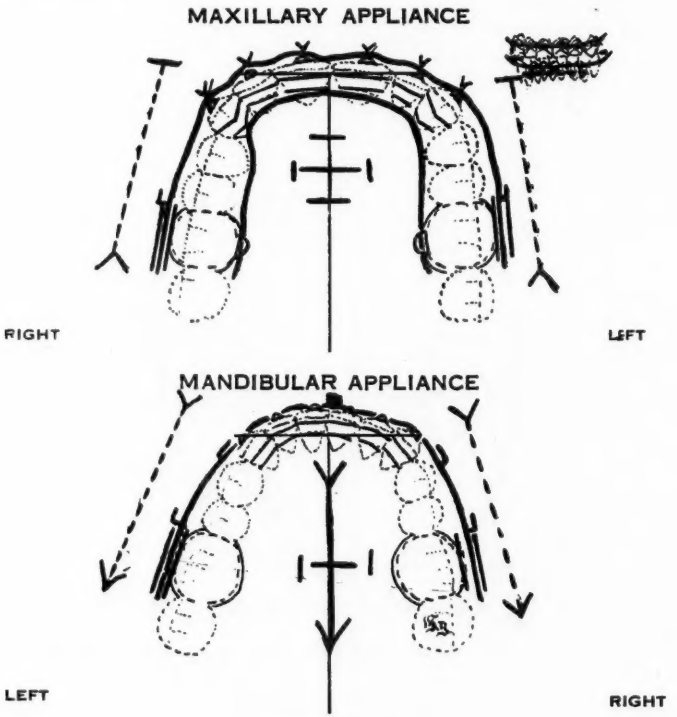


PROCEDURE

TO RETRACT 3 2 1 | 1 2 3. CHECK INTERPOSITION OF THE LOWER LIP AT ONCE, AND COMMENCE MUSCLE EXERCISES TO DEVELOP UPPER LIP.

Fig. 12.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*.



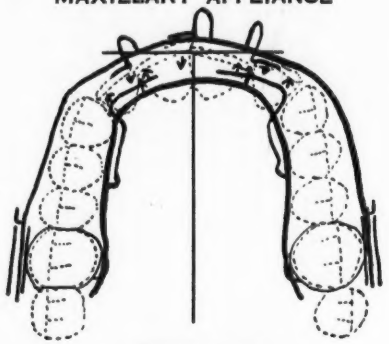
PROCEDURE

TO RETRACT THE MANDIBULAR ARCH. IF REQUIRED ATTACH TRACTION BAR TO SPUR. FOR OCCIPITAL ANCHORAGE.

Fig. 13.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

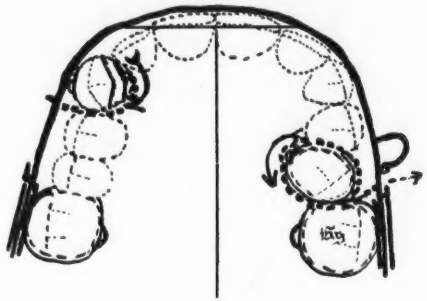
PROCEDURE

TO ALIGN 2 1 | 1 2.

Fig. 14.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

PROCEDURE

TO ROTATE 3 | 5.

Fig. 15.

Fig. 16. The action is very positive with little risk of producing undesired displacement.

Mesiodistal movement of individual teeth can best be accomplished by means of recurved finger springs attached to a lingual arch as illustrated in Fig. 17. The labial arch acts as a stabilizer of the arch form.

To stimulate the eruption of maxillary canines, the teeth are banded and a loop is soldered at a convenient location for attachment. A finger spring is soldered to a labial or lingual arch, as in Fig. 18, and the teeth are ligated to the finger springs.

To depress individual teeth, finger springs running from a labial or lingual arch are adjusted to bear on the occlusal surface or incisal edge of the affected teeth. Fig. 19 illustrates such an appliance for depressing two maxillary in-

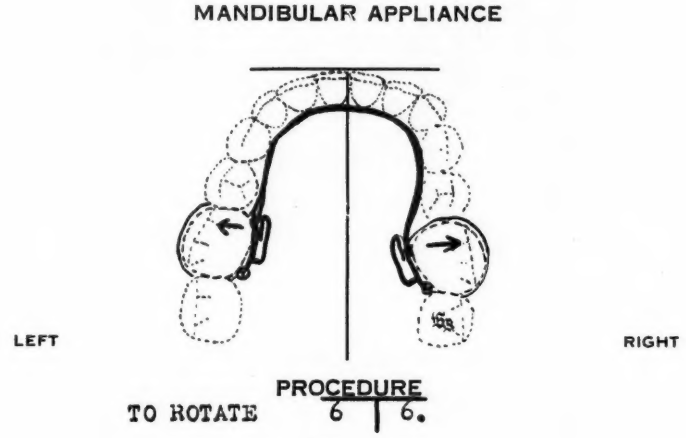


Fig. 16.

cisors. In the case of unevenly erupted mandibular anteriors, a Hawley bite plate with an inclined plane can be used effectively to obtain an even plane of occlusion, Fig. 20.

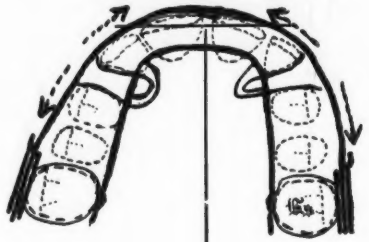
To shift the center lines of the arches. A certain type of case is common at about twelve years of age, where the teeth have erupted in even alignment at the expense of one second premolar in opposite sides of the dental arches. This is because these teeth have been last to appear, and are therefore impacted. The center lines of the arches in these cases are correspondingly shifted. Intermaxillary anchorage may be used to good effect in connection with threaded end sections as illustrated in Fig. 21, to correct the malocclusion.

MODIFICATION OF THE MUSCULAR ENVIRONMENT OF THE DENTURE

Rogers has drawn more attention to the influence of muscle action on the form of the denture and has effectively demonstrated the importance of checking improper muscle habits and of instituting correct function or increased function as an adjunct of treatment, and occasionally as a positive part of the process. While physiology is not the entire factor in orthodontia, it cannot be denied that it bears a tremendous influence on our results, and this matter must never be overlooked in planning methods for the regulation of malocclusions.

Pencil: *Outlines of Teeth*, **Black:** *Bands & Attachments* **Red:** *Appliances & Directions of Force*

MAXILLARY APPLIANCE



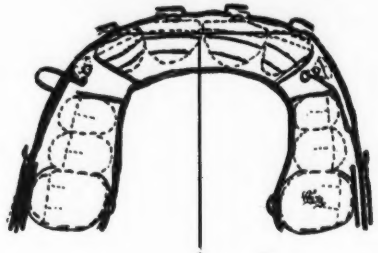
RIGHT LEFT

PROCEDURE
TO OPEN SPACES FOR $\frac{3|3}{}$.

Fig. 17.

Pencil: *Outlines of Teeth*, **Black:** *Bands & Attachments* **Red:** *Appliances & Directions of Force*.

MAXILLARY APPLIANCE

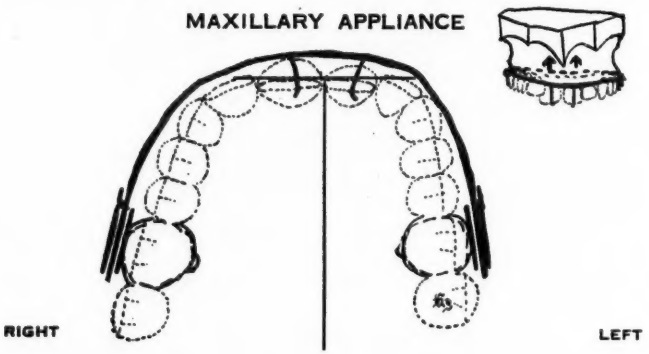


RIGHT LEFT

PROCEDURE
TO ASSIST THE ERUPTION OF $\frac{3|3}{}$

Fig. 18.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

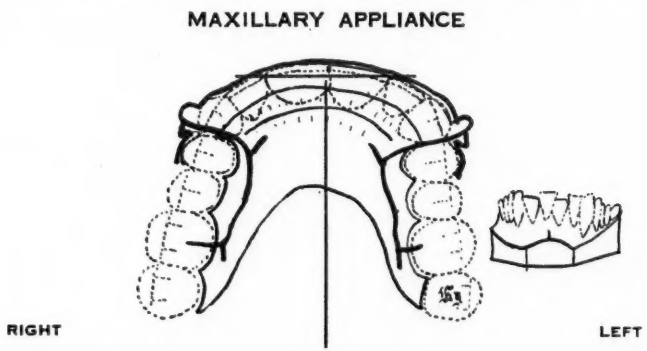


PROCEDURE

TO DEPRESS $\frac{1}{1}$.

Fig. 19.

Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*



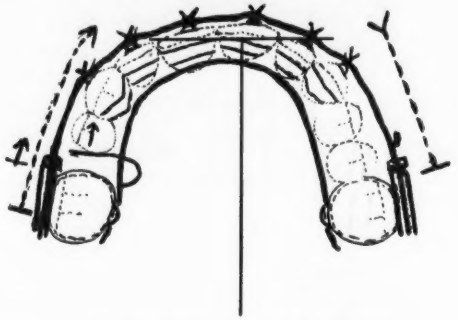
PROCEDURE

TO DEPRESS UNEVENLY ERUPTED LOWER INCISORS.

Fig. 20.

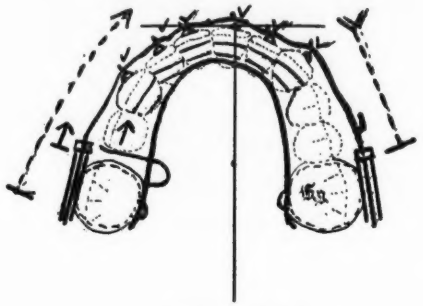
Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

MANDIBULAR APPLIANCE



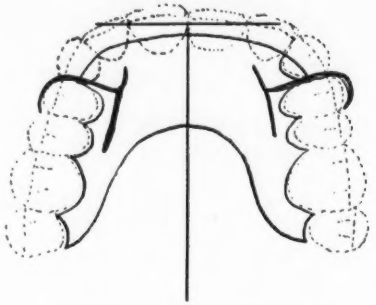
LEFT RIGHT

PROCEDURE
TO SHIFT THE ARCHES AND ACCOMODATE 5/5

Fig. 21.

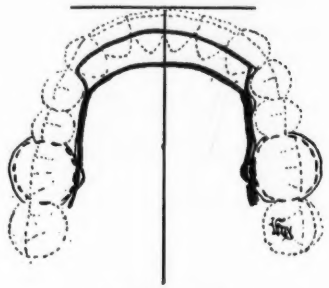
Pencil: *Outlines of Teeth*, Black: *Bands & Attachments* Red: *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

MANDIBULAR APPLIANCE



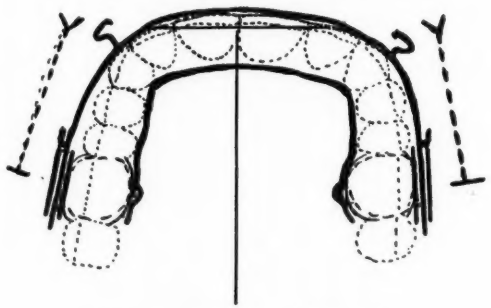
LEFT RIGHT

PROCEDURE
TO RETAIN LATERAL DEVELOPMENT.

Fig. 22.

Pencil: *Outlines of Teeth.* **Black:** *Bands & Attachments* **Red:** *Appliances & Directions of Force*

MAXILLARY APPLIANCE



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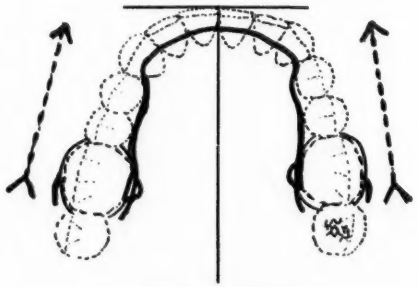
MANDIBULAR APPLIANCE



LEFT RIGHT

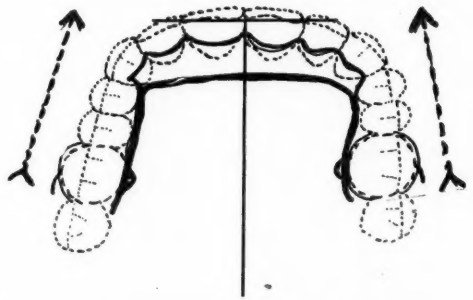
PROCEDURE

TO RETAIN ANTERIOR DEVELOPMENT OF THE MANDIBULAR ARCH, WEAR ELASTICS AND LABIAL ARCH AT NIGHT. FOLLOW BY BITE PLATE.

Fig. 23.

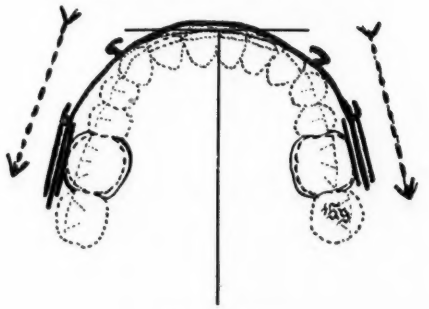
Pencil: *Outlines of Teeth.* **Black:** *Bands & Attachments* **Red:** *Appliances & Directions of Force*

MAXILLARY APPLIANCE



RIGHT LEFT

MANDIBULAR APPLIANCE



LEFT RIGHT

PROCEDURE

TO RETAIN RETRACTION OF THE MANDIBULAR ARCH. WEAR ELASTICS AND LABIAL ARCH AT NIGHT.

Fig. 24.

In the case of atonic lips, commonly associated with prominent maxillary anteriors, steps are taken at the initial stage of regulation to develop the lips to their normal tone, and to seal the mouth effectually when they are at rest. As a result the denture is generally assisted in assuming its normal form, the appearance is markedly improved, and the denture is given its best chance of maintaining its corrected form.

Where the lower lip is interposed between the dental arches, the aim of muscle training is to remove the interference and simultaneously to alter the form of the denture to its normal state, making it rather difficult for the patient to reinsert the lip habitually. The retention in these cases is provided by a simple mandibular lingual arch, by developing the tone of the upper lip, and by conscientious cooperation on the part of the patient in breaking the habit.

The correction of mouth breathing involves three separate factors. It must first be possible for the patient to breathe freely through the nose. This matter belongs in the field of the rhinologist. Next, the form of the denture should enable the patient to close the lips readily in order to seal the mouth. As a matter of fact the lower lip seems to be interposed between the arches as a positive effort on the part of the patient to seal the mouth for breathing purposes. When the form of the denture has been made normal, the lips should be developed to a good firm tone by muscle exercises, and forced nasal breathing exercises instituted to distend the nasal passages if possible.

RETENTION

The problem of retention varies so much even for cases of exactly the same type, that it is purely a matter of trial for each case. The principles of retention, as I see them, are to train the organs to function properly, and to allow sufficient time to elapse in each case to enable the osseous tissues to develop about the altered structure in sufficient density to perform the function of mastication and maintain their new form. The patient is instructed to use the masticating apparatus vigorously, to breathe properly, and to maintain the tone of the lips. Mechanical retention is of the simplest type, permitting the teeth to move freely and be easily cleaned.

To retain lateral development, a simple lingual arch is used on the mandibular arch and a Hawley base plate on the maxillary arch. The base plate is gradually left on for longer and longer intervals as it ceases to be tight on insertion, Fig. 22.

To retain cases where the mandibular arch has been developed anteriorly, a heavy gauge removable labial arch and a simple lingual arch with buccal hooks are used with intermaxillary elastics at night, as illustrated in Fig. 23. This is followed by a Hawley base plate with a bite plane as in Fig. 20, when the elastics are discontinued. My aim is to discontinue all appliances as soon as possible, but this can only be ascertained by trial.

To retain cases where the mandibular arch has been retracted, a contoured maxillary lingual arch with buccal hooks on the molar bands, and a removable mandibular labial arch are used with intermaxillary elastics at night.

When the relations appear to be definite, a simple Hawley base plate is worn, similar to the one in Fig. 22 and gradually discontinued. The appliances described are illustrated in Fig. 24.

CONCLUSION

My customary methods of regulation have been presented. While mechanical methods of regulation cannot be considered entirely compatible, every effort is made to conform with the best understanding of the times, and to be guided by actual results in practice. When our leaders bring forward more effective or more physiologically correct devices, the present methods will readily be modified, replaced or discarded as the case may be, always to the best interest of the patient, which is the sole consideration of any moment.

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2. Idem: A Consideration of Orthodontic Attachment, INTERNAT. J. ORTHOD. ORAL SURG. & RADIOG. **17**: November, 1931.
3. Idem: Physiologic Diagnosis: A Key to the Regulation of Complex Malocclusions, INTERNAT. J. ORTHOD. ORAL SURG. & RADIOG. **16**: 42, 1930.

SOME MODIFICATIONS ON THE LABIAL AND LINGUAL ARCH TECHNIC*

By Andrew Francis Jackson, D.D.S., Philadelphia, Pa.

THREE years ago at the meeting of this Society in London, I had the pleasure of presenting a short paper describing the technic I have been using in my practice of the construction and application of the labial arch with auxiliary springs. Since then I have added certain modifications and additions which I have found useful and which I take great pleasure in presenting at this time.

I believe it is possible to accomplish practically every conceivable type of tooth movement by the use of labial and lingual appliances with auxiliary springs. I also believe that all force should be of the gentle, continuous variety which is best obtained by auxiliary springs.

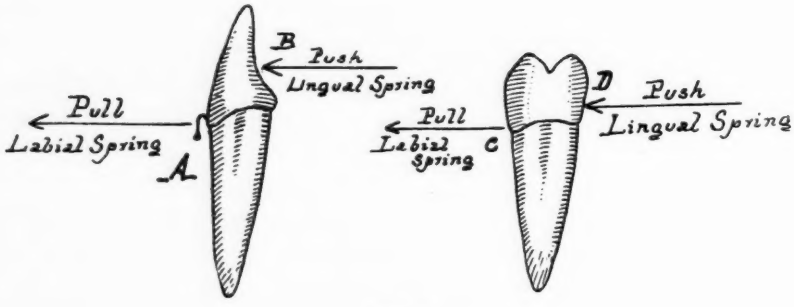

Fig. 1.

All mechanical tooth movement is accomplished by either a push or a pull force. The positions at which these forces are applied are the determining factors as to which is the more desirable for any given effect to be produced. Fig. 1 illustrates in diagrammatic form the positions at which these forces are usually applied. A pull applied at *A* has the effect, in almost all cases, of moving a tooth bodily, root as well as crown, without any depressing effect of the tooth in its socket. A push applied at *B* has the effect of moving the tooth in the direction to which the push is applied but also of tilting the tooth labially, as well as depressing it in its socket. This applies to all cases where the push is placed on an inclined surface, as on incisor teeth. Either one of these effects may be desirable or undesirable, depending upon the nature of the case. A pull applied at *C*, or a push at *D* does not usually make much material difference, as the push at *D*, as on premolars and molars, is against a straight surface and does not produce tilting or depression.

In most cases, where premolars or molars are to be moved, the push obtained from an auxiliary spring on a lingual arch is preferable to a labial pull on account of the greater simplicity of the construction of the necessary appliance.

* Read at the 1930 Congress of the European Orthodontological Society, at Zurich.

The details of the construction of the labial appliance with auxiliary springs, which I have been employing in treatment, has been dealt with in an article published in the *Dental Record* (1927). I wish here to describe the construction of the lingual arch including the lingual lock and the reasons for employing this type.

Fig. 2 illustrates in diagram the construction of this lock. A section of round tubing, of desirable length, is soldered on the band in the distolingual area, and a bracket hook is soldered in the mesiolingual area. The construction of this bracket hook is illustrated in its successive steps. A piece of 0.030 wire is bent as in *A, B, C* and *D,* and soldered to the band just above the gum line as in *E*. This is then cut off, leaving only sufficient length for the arch to rest upon. A section of 0.022 wire is then soldered to this at a point just above the mucous

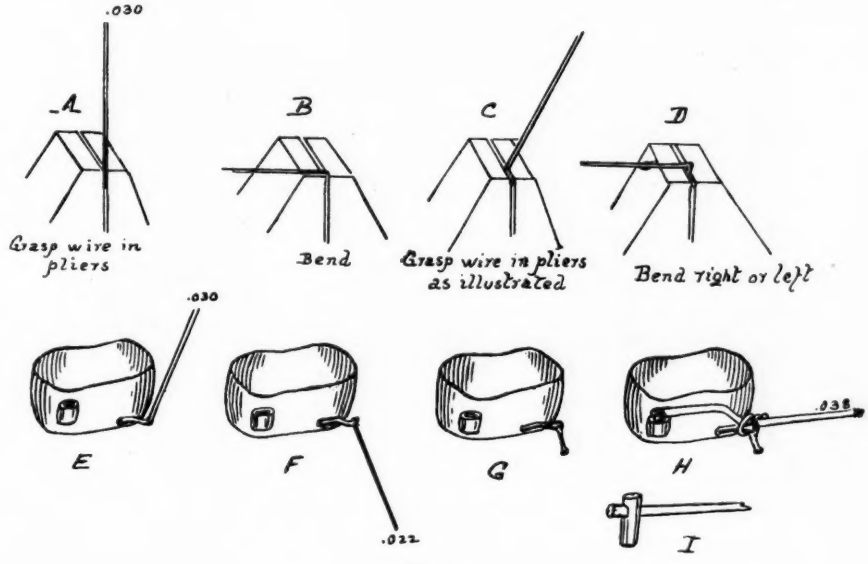

Fig. 2.

membrane so that when it is finished, it will neither impinge on, nor stand too far away from, the mucous membrane and cause irritation either to the mucous membrane or to the tongue. A short section of this is cut off and a ball melted on the end as in *F* and *G*. The section of wire, fitting into the tube, should be soldered to the lingual appliance in an offset joint as shown in *I*. This permits the lingual appliance to fit snugly against the band, which would not be possible if a butted joint were employed. The lock is completed by tying the lingual appliance to the bracket hook as shown at *H*. This is done with ligature wire, and the ends of the wire are tucked carefully away between the body wire and the band between the molar and the premolar.

Some reasons for using this type of lock are illustrated in Fig. 3. Occasionally there are exceedingly short teeth to be dealt with as in *A*. This type of lock may be employed very satisfactorily by making the tube a mere ring. The two points of support, the tube and the bracket hook, make the anchorage quite stable without any gum irritation. When only one point of support is employed, as is the common practice with the half-round tubing, the stability of the appliance depends upon the length of the tube of the lock.

I have found it very desirable to support the lingual body wire by means of bands cemented on the incisor teeth, with knobs or hooks conveniently located to allow the lingual appliance to lie snugly under them. In inserting a lingual appliance, under these conditions, the round tube is a great advantage, as it allows one end to be inserted first, permits the post to rotate within the tube and thereby makes it possible to swing the body wire in under these knobs to the point where the post on the opposite side can be inserted in its tube. This is illustrated in *B*.

In the construction of lingual cribs, as illustrated in Fig. 3, *C* and *D*, this lock also permits of a stability which is very desirable. For extra stability, occasionally very desirable, extra bracket hooks may be soldered on bands on the premolars. This makes it almost impossible of displacement without intentional purpose on the part of the patient.

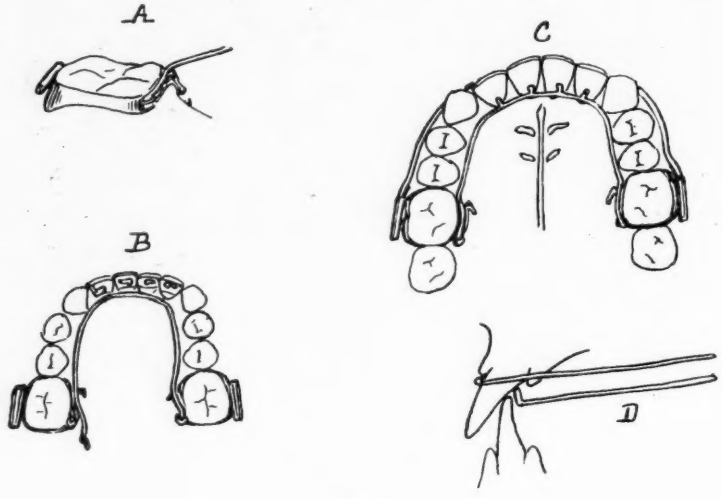

Fig. 3.

I make all my lingual appliances directly in the mouth as illustrated in Fig. 4, making them in two sections and soldering them together by a lapped joint. The use of the round tube makes the construction of lingual appliances a much simpler matter under these conditions than when half-round tubing is employed. The making of lingual appliances in situ, when they are to be employed as cribs, is of great benefit, as it permits exact observation of the bite in its relation to the most desirable position which the crib should occupy.

When intermaxillary elastics are employed, the usual custom is to attach them from the posterior ends of the buccal tubes to hooks on the appliances of the opposite jaw. When an intermaxillary elastic is applied in this manner from the mandibular molar, the result is to tilt the molar forward. When the molar band is attached to a lingual appliance, the action tends to depress the incisors because of pressure on the inclined lingual surfaces. The action of these rubbers is to draw the molars anteriorly, and where only an unsupported lingual body wire is employed, the effect is to reduce the space and crowd the mandibular incisor teeth. Depending on the case, this may cause very undesirable effects by producing open-bite. To obviate this, if the lingual appliance is stabilized by

having it lie snugly under knobs attached to bands on the incisor teeth, buckling can be avoided. If, instead of attaching the rubber to the posterior end of the buccal tube, a bar with a hook on the end is soldered to the buccal surface of the molar band and the intermaxillary elastic is attached to this hook, the effect will be to tilt the molar posteriorly and this will be transmitted to the incisor teeth through the lingual appliance. These will be elevated instead of depressed, and

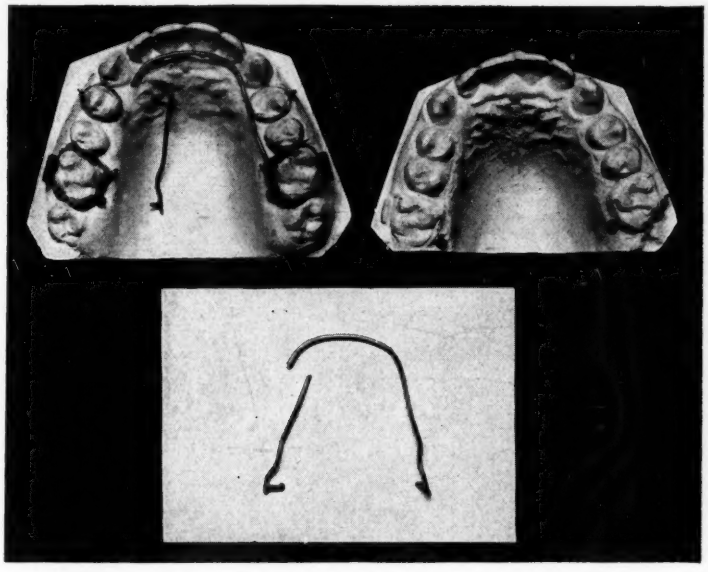

Fig. 4.

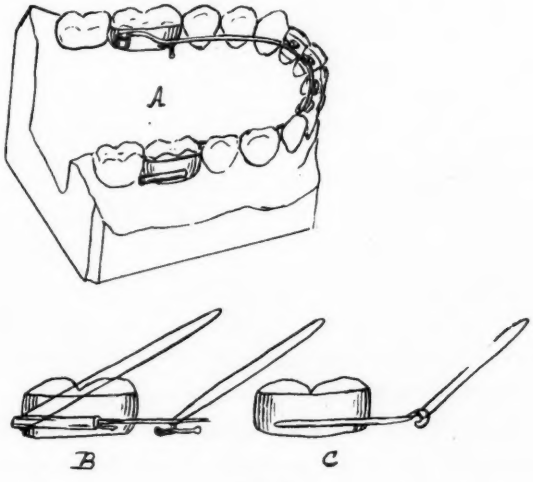

Fig. 5.

the result will be to close the bite. I have found, from actual experience, that this method of dealing with this particular problem is of great practical value. This is illustrated in Fig. 5. The hook at *C* can be made of any length depending on circumstances. Likewise, if a labial appliance is being used, the hook for the intermaxillary rubber can be attached at any chosen point on the arch as in *B*.

When intermaxillary elastics are used from the posterior ends of buccal tubes on the maxillary molar bands, customary in the treatment of mesioclusion cases, the action is to tilt the molars mesially. If a lingual appliance is employed in conjugation, the effect is to depress the incisor teeth by the pressure exerted on the inclined planes. This is exceedingly undesirable and may prove disastrous where the case is an actual open-bite case or has a strong tendency in that direction. To obviate this and to produce the opposite result, a hook soldered on the labial appliance, as in Fig. 6 *A*, completely reverses the action of the intermaxillary elastic in this respect. An intermaxillary elastic, attached to such a hook as illustrated, tends to tilt the molar distally. If this effect is transmitted through the labial appliance to the incisor teeth, banded with appropriate hooks or knobs, the action is to close the bite. I have found by experience that in cases of this

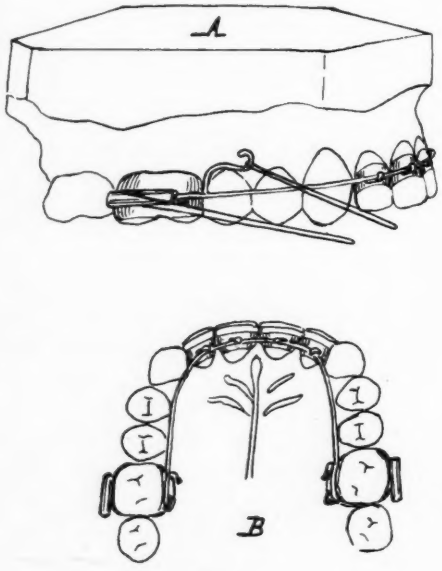

Fig. 6.

kind, where this method is employed, it is desirable also to employ in conjunction with the labial appliance a lingual appliance, which lies snugly under hooks or knobs, soldered to the lingual surfaces of the incisor bands.

Vulcanite retainers, as commonly constructed and used, are of great value, but have the inconvenience of often breaking at the point where the gold wire enters the vulcanite. This often necessitates the construction of a new retainer. After considerable experimenting in my office, my associates, Dr. Patton and Dr. Sager, and I have developed a modification of the retainer as illustrated in Figs. 7 and 8. It permits of easy repairing and an unlimited variety of attachments, extremely useful not only in the retention but in the actual treatment of cases. The technic of construction is as follows: a plaster cast is obtained of the case and two sets of parallel tubes are vulcanized into the plate as in Fig. 7 *B*. These are attached to the vulcanite by soldering them in pairs to a section of wire with recurbed ends as in Fig. 7 *A*. In order to preserve the original model, an impression in modelling compound is taken of the lingual surface of the model, and a second model is obtained from this. The original model returns from the

laboratory holding a perfectly fitting vulcanite plate with the four tubes in place. The tubing which is used is of the size to accommodate 19 gauge or 0.038 in. wire. The removable section as illustrated in Fig. 7 *C* is constructed of 0.030 in. wire. The sections of wire which fit into the tubes are made long enough to extend for a short distance beyond the length of the tubing and by bending the protruding

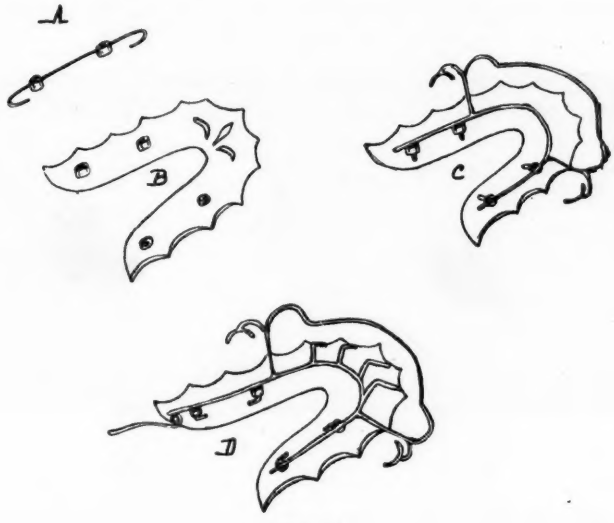

Fig. 7.

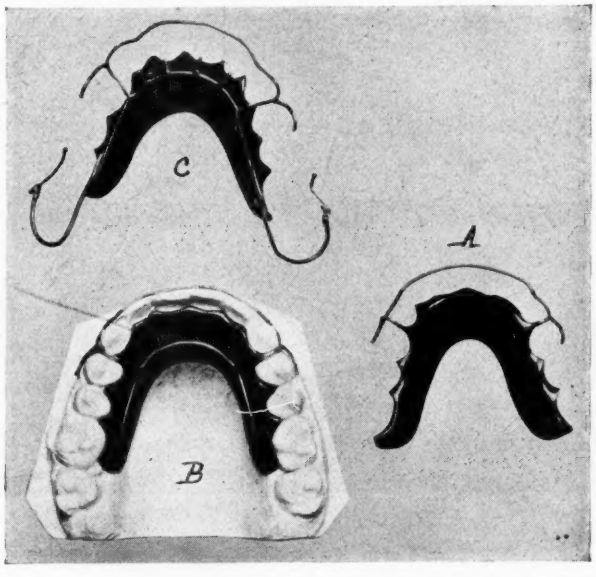

Fig. 8.

ends toward each other, as in Fig. 7 *D*, the removable section is very simply and securely locked in place. Fig. 7 *D* also illustrates in diagrammatic form the construction of a removable crib and a finger spring, useful occasionally in moving a second molar to place. The simplicity and ease with which repairs and useful attachments are added to this retainer are very strong recommendations for its use.

Fig. 8 is a photograph of three retainers: *A*, the regular retainer; *B*, a regular adjustable retainer, constructed as described; and *C*, a retainer which was used in actual practice, to shorten the bite and elongate the molars. In this last case extensions of the lingual body wire were made beyond and around the second molars, from the lingual to the buccal surfaces, and springs were attached to these ends. They engaged hooks on the buccal surfaces of bands, which were cemented to the first molars. I have found this method admirable in dealing with

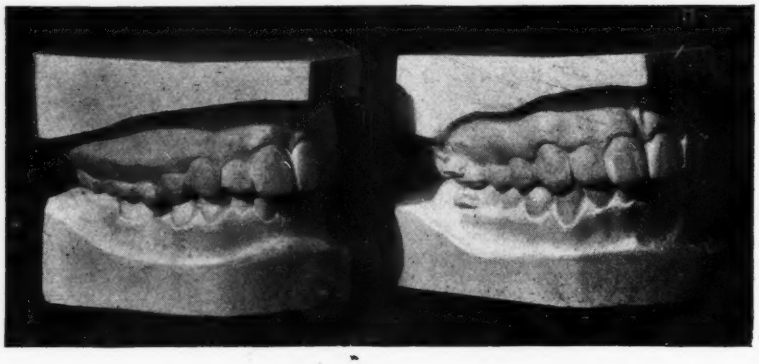

Fig. 9.

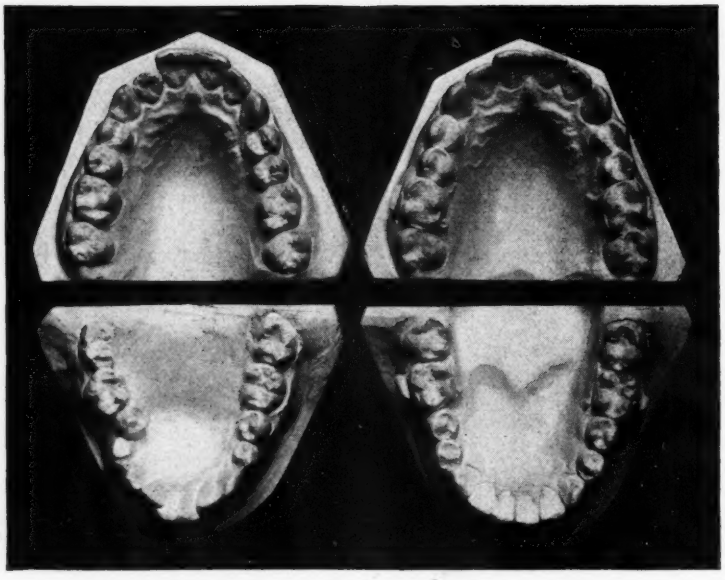

Fig. 10.

cases which require such treatment—in some cases accomplishing much of the work before any fixed orthodontic appliances are installed.

Figs. 9, 10, 11 and 12 illustrate a case in which combinations of the labial and lingual arches with auxiliary springs were employed. On the mandibular arch a labial arch was adjusted. Bands with bracket hooks were placed on the mandibular canines; a labial auxiliary spring was soldered to the arch just anterior to the mandibular left canine and sprung into position under the hook on the mandibular right canine in order to move it mesially and labially. It thereby created

space for the accommodation of the second mandibular right premolar. A buccal spring was attached just anterior to the mandibular left molar, and sprung under the hook on the mandibular left canine, thereby allowing the mandibular incisors

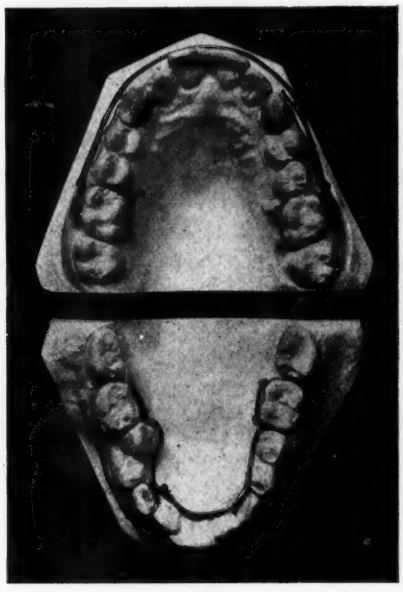

Fig. 11.

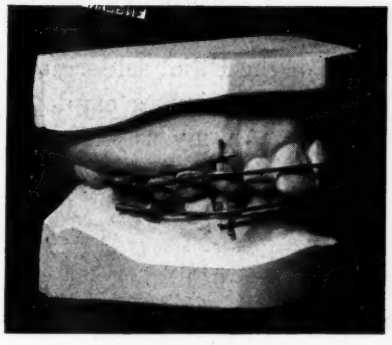

Fig. 12.

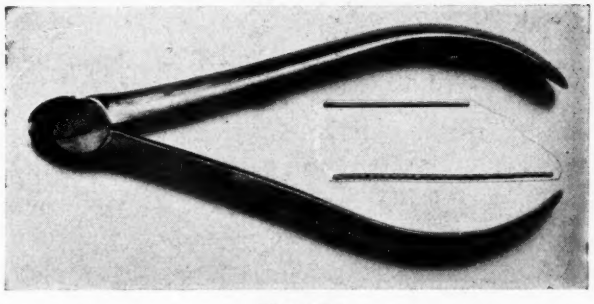

Fig. 13.

to drift to the left. A lingual arch with auxiliary springs was also adjusted to create expansion in the premolar regions. On the maxillary a labial arch was adjusted with auxiliary springs attached to the maxillary canines to move them

buccally simultaneously with the movement of the mandibular teeth to create the necessary expansion and obviate the trauma which would otherwise occur. A lingual arch with auxiliary springs was employed to effect the expansion in the premolar regions. The total period of time to make those changes was just one year.

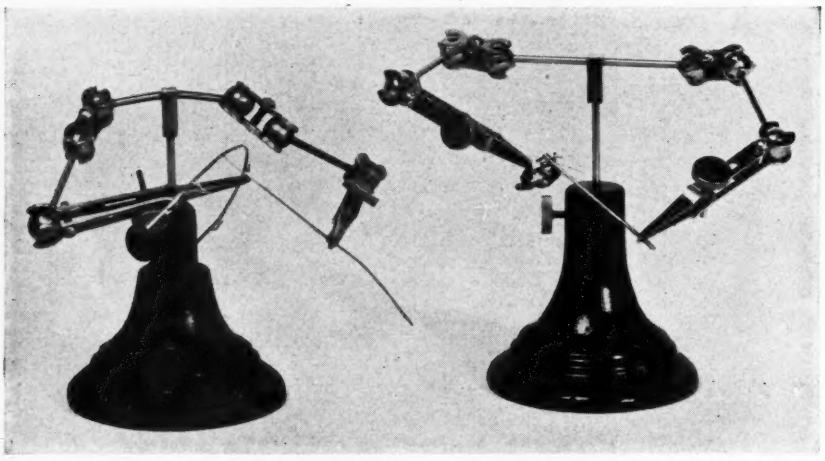

Fig. 14.

Fig. 13 illustrates a pair of wire-stretching pliers which are employed to effect all the enlargements in both the lingual and labial arches. All pinches made are immediately filled with high carat solder.

Fig. 14 represents two sets of the Elliot soldering appliance which I use constantly in the construction of all appliances employing the ordinary Mellotte blowpipe to do all my soldering. All my appliances are made directly in the mouth.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

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DEEP BLOCK ANESTHESIA OF THE SECOND AND THIRD DIVISIONS OF THE FIFTH NERVE* †

By James Barrett Brown, M.D., St. Louis, Mo.

OPERATIONS about the jaws, mouth, and face may frequently be carried out under anesthesia produced by blocking the second and third divisions of the fifth nerve deep in at their exits from the cranial cavity. For some procedures this anesthesia may be the one of choice, and the rather wide range of usefulness is indicated in the summary.

Preoperative medication is important, as for any anesthesia; however, if full cooperation of the patient is desired during the operation, hypnotics are not given in full doses, and we have omitted preliminary medication entirely several times. The preliminary winning of the patient's confidence, the reducing of the pain of injection to a minimum, and the avoidance of operating outside of the field of anesthesia are as important as the use of sedatives before operation.

The technic of the injection is not difficult, and, so far, we have had no real difficulties from its use. A good knowledge of the anatomy of the region is, of course, important, and this combined with practice will be of more benefit than any set of rules for the exact movements of the needle.

The injection of novocain is not comparable to the injection of alcohol for neuralgia, even though the procedures are similar. In anesthesia, a rather harmless fluid is used, accurate location of the nerve is not necessary, and fairly large amounts of fluid can be used without harm. In using alcohol, the procedure must be much more exact, the nerves accurately located (if relief of any duration is hoped for, and, because of the effect on the surrounding tissues, relatively small amounts used. Many complications may arise from the use of alcohol and disastrous results occur, such as deafness, blindness, necrosis of bone, sloughs of soft tissue, and fibrous ankylosis of the mandible.

*From the Service of Dr. V. P. Blair, Department of Surgery, Washington University School of Medicine.

†Reprinted from Surgery, Gynecology and Obstetrics, 53: 832, 1931.

When the injecting is done ahead of the advancing needle, there need not be extreme discomfort. There is usually sharp pain when the nerve trunk is struck, although with infiltration of the area without directly puncturing the nerve, even this discomfort may not occur. Palpitation occurs as frequently as when novocain-adrenalin solutions are used elsewhere. Syncope occurs rarely and, if it is recognized at the onset, simply lowering the head of the table will suffice in most cases. We do not make the injection with the patient sitting erect.

When complete anesthesia is obtained, it is usually such a revelation to the patient that he is likely to cooperate very well. Notable examples of this occur in patients with fractured jaws. Even though relieved of pain by the injection, we have found them able to tell when the jaws have been brought into their normal occlusion. One patient (of this series) who suffered from an automobile accident, had his left eye blinded and the whole maxilla pushed far over to the right. In the reduction it was necessary to manipulate the lower border and floor of the orbit under the one good eye. This required close cooperation, and he was able to tell each time during the operation when he felt any sensation around his good eye. The importance of this was that there might possibly have been some damage to the eye muscles or even to the optic nerve if the patient had not been awake and able to talk.

Postoperative pain (as the effect of the novocain is wearing off) is not so marked as that which frequently follows peripheral block of the infraorbital or mandibular nerves, and there is not the persistent soreness to contend with about the point of injection that occasionally follows injection of the peripheral branches.

TECHNIC OF THE INJECTION

It is well to have a skull available for reference during the injection. Usually a No. 20, 3½-inch needle is used with an ordinary 2 cubic centimeter glass syringe, but the special, heavy, rather blunt needles with centimeter markings may be used. The use of the same outfit each time may make for more accurate work.

The first superficial landmark is the lower border of the zygomatic process at about its middle. The next landmark is the condyle of the mandible; this can usually be felt by palpating deeply back along the lower border of the zygoma and having the patient protrude the mandible. The condyle is felt as it slides forward on the articular tubercle. If not felt, the lower border of the zygoma 2 to 2.5 cm. in front of the tragus is the landmark.

Superficial anesthesia is done with a fine needle. The long needle is then inserted slowly and novocain injected ahead of it through the sigmoid fossa (space between the condyle and coronoid of the jaw), and in through the deeper tissues (40 to 50 mm., average 43—Blair) until it gently strikes the external surface of the external pterygoid plate (the third landmark). "If the needle penetrates deeper than would be expected from the size and contour of the skull without striking the process, it should be withdrawn somewhat and thrust slightly forward and upward, for it may have passed behind the process" (Blair). This would usually be evidenced by the patient's feeling some pain in the mandible, because the third division lies posterior to the posterior edge of the plate. From

here, by short withdrawals and reinsertions, the needle is carried up to the base of the plate until the undersurface of the great wing of the sphenoid is felt. The sphenomaxillary fossa lies forward and the foramen rotundum just above the top of the plate. Therefore, to inject the second division, the point of the needle is carried forward (keeping well up against the greater wing), until it drops off of the pterygoid plate. The point should not go over 0.5 to 1 cm. deep into the fossa. If the nerve or its immediate vicinity is struck, the patient will have pain in the upper lip and teeth, and it is at this point that the solution is to be deposited; 2 to 4 cubic centimeters (2 per cent solution with 0.5 to 1 drop of adrenalin per cubic centimeter) are usually enough if a close hit has

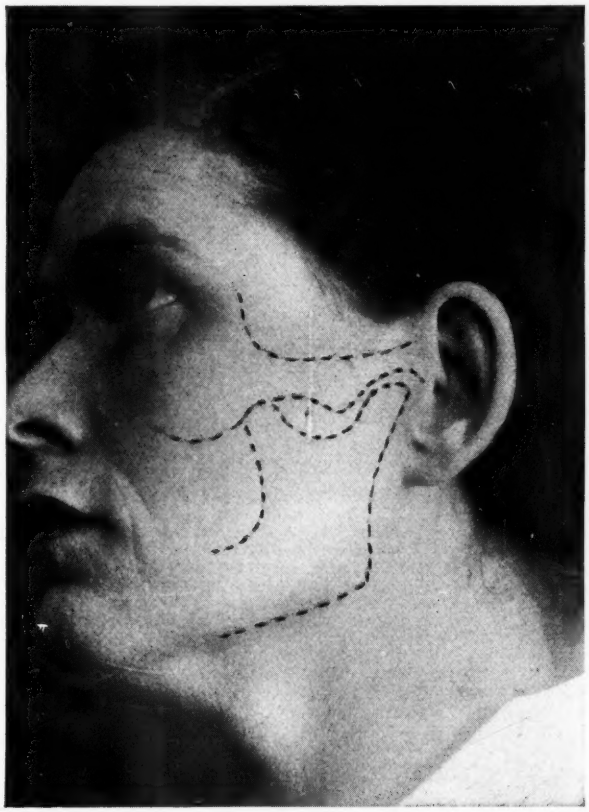

Fig. 1.—Shows the bony landmarks roughly located by palpation. The lower border of the zygoma is determined first and then the condyle by having the patient open or protrude the mandible. It is nearly always definitely felt as it slides forward on the articular tubercle (eminence). The point of insertion of the needle is 2 to 2.5 centimeters in front of the tragus just below the lower border of the zygoma. From here it passes between the coronoid process and the condyle of the mandible (sigmoid fossa) and just anterior to the articular tubercle. Occasionally it may be necessary to have the mouth held open so the space between the zygoma and the mandible may be increased.

been made. For anesthesia (in contradistinction to an alcoholic injection for fifth nerve neuralgia), a direct hit is not needed, and so more than 4 cubic centimeters may be needed to get sufficient absorption into the nerve. As the needle is worked forward on the pterygoid plate, it may have to be withdrawn a considerable distance to get the correct forward angle from the skin puncture. With practice and observation of the variations of the bony plate, fairly direct passage can be made with the needle from the first skin puncture. Location of the second division may be a little more difficult than that of the third division, because

from the skin puncture the needle tends to travel almost straight in to the third division, whereas the second division lies farther forward in the sphenomaxillary fossa, and the reflection of the anterior edge of the pterygoid plate from the base of the sphenoid may present a distinct elevation that the point of the needle must surmount before it can drop into the fissure.

The sphenopalatine ganglion lies a little lower than the second division and, if the injection is not placed high enough, there might occur some anesthesia about the palate without anesthesia of the external face and lip.

To inject the third division, the needle is carried backward, being kept up in contact with the under surface of the greater wing of the sphenoid. The foramen ovale is just above and behind the pterygoid plate and just as the needle

Fig. 2.—Shows approximate relation of needle and bony landmarks. Needle represented by a straw held in place with modelling clay. On its course inward to the pterygoid plate the needle passes through the parotid gland, the masseter, temporal, and external pterygoid muscles. It may also encounter the transverse facial, internal maxillary, middle meningeal, and masseteric arteries. So far we have not seen any untoward results from the passage of the needle through these structures, although we have had several brisk hemorrhages through the needle.

As pointed out by Blair,* a skull affected by osteoporosis may allow deep penetration of the needle without finding the pterygoid plate, or may allow entry into the cranial cavity or antrum, if the abnormality is not recognized.

drops off of the plate, the nerve is usually encountered, as evidenced by pain in the mandible or ear. The solution is deposited here. The needle should not go back or deeper in more than 0.5 centimeters for fear of injury to the eustachian tube or of puncturing the internal carotid or middle meningeal artery, or of entering the pharynx. If the needle goes straight in just anterior to the articular eminence, it may tend to pass entirely posterior to the pterygoid plate. For this reason it is seldom necessary to carry the needle very far posterior after the plate has been struck. On three occasions some fluid entered the pharynx when the third division was injected. No harmful effects resulted, but this is certainly to be avoided.

The general rules for the use of local anesthetic formulated by Braun, Labat, Farr, and others should be followed closely. Gentleness and quietness are prerequisites. The solutions, syringes, and needles should all be checked properly, asepsis rigidly enforced, lateral movements of needles should not be made unless the needles are withdrawn and reinserted in the required direction, injections should be made slowly, and the plunger withdrawn frequently to see

if blood is entering the needle. If blood does appear, the needle should immediately be withdrawn from the area, and preferably entirely withdrawn and washed out. In one patient, there was brisk hemorrhage into the syringe and instead of withdrawing the needle, 1 cubic centimeter of solution was injected directly into the artery. There was immediate severe occipital headache that persisted for about one hour. General anesthesia as a supplement has not been necessary in this series, but in two cases of radical dissections for carcinoma not recorded here, it was thought best to change to it.

Additional injections of adjacent fields are frequently necessary. The branches of the first division on the same or opposite side of the deep block

Fig. 3.—Shows the deep course of the needle. After gently striking the pterygoid plate, by short withdrawals and reinsertions, the point of the needle is carried up to the under surface of the great wing of the sphenoid, which is about at a right angle to the pterygoid plate. From now on this undersurface of the greater wing is equally important as a landmark as the pterygoid plate itself.

To inject the third division the needle is carried backward by short withdrawals and reinsertions against the pterygoid plate and being held up against the sphenoid wing. When the posterior border of the plate is reached, the needle slips off and the patient usually experiences momentary severe pain. The fluid is injected here. It is not absolutely essential to get the pain of a direct "hit" of the nerve before injecting the fluid. If it is not thought that a direct "hit" has been gotten, an extra amount of fluid may may be deposited and a longer time should be allowed for the development of anesthesia. (Ten minutes may be necessary.) It is important to remember the rule of not going posteriorly or deep more than 0.5 to 1 centimeter from the edge of the plate. Damage be deposited and a longer time should be allowed for the development of anesthesia. chian tube. The pharyngeal mucosa may even be punctured and fluid gotten into the throat. (This might also happen if enough were deposited in the eustachian tube.)

It is also possible to go entirely through the foramen ovale and to inject the ganglion directly. This has not been done so far, nor have attempts been made to inject the first division, because it is thought that the probable paralysis of other nerves and the puncture of the dura might not justify the procedure.

To inject the second division, the needle is carried forward to the sphenomaxillary fossa and the fluid deposited here. Straws are placed to show the third division emerging from the foramen ovale and the second division coursing across the sphenomaxillary fossa.

may require anesthetizing. The zygomatic, supratrochlear and infratrochlear, and external nasal branches are usually anesthetized by a regional infiltration or block. The supraorbital branch is blocked directly at the supraorbital notch or foramen, and the nasal nerve deep in the orbit at the anterior ethmoidal foramen which is approximately at the center of the medial wall of the orbit. Any of the peripheral branches of either of the second or third divisions that have not themselves been blocked should be anesthetized if their field is to be invaded. Operations about the lower part of the ear and about the neck require local infiltration or superficial or deep block of the cervical nerves.

The solutions used are: (1) For blocking the second and third divisions and their peripheral branches, 2 per cent novocain with 1 drop of adrenalin to every 1 or 2 cubic centimeters. With accurately placed injections, small total amounts are required and the amount of adrenalin is not excessive. (2) For deep block in the orbit, 2 per cent novocain with 1 drop of adrenalin to every 2 to 4 cubic centimeters is used. (3) For local infiltration, ½ per cent novocain with 3 drops of adrenalin to every 30 cubic centimeters of solution. (4) For regional block of the branches of the first division and for superficial and deep regional block of the cervical nerves, 1 per cent novocain with 3 drops of adrenalin to 30 cubic centimeters.

SUMMARY

A total of 96 injections of the second and third divisions of the fifth nerve (second division, 47; third division, 49) were done on 54 patients (43 men, 11 women) on whom 57 operative and 4 diagnostic procedures were carried out. Both right and left second and third divisions were injected on two occasions.

Excellent anesthesia was obtained in every case except in one in which uninjected ninth nerve fibers gave some discomfort, and in three in which the radiocautery knife was used and the pain of the current tended to extend outside the field of injection. Several extremely nervous individuals, including aged men and women, one imbecile, one frightened negro girl, and two frightened foreigners went through their operative procedures excellently. In 11 patients no other anesthesia available would have been satisfactory. Tracheotomy was probably avoided in seven patients by the use of the deep injection in place of any form of general anesthesia. No deaths occurred in the series.

Undesirable symptoms occurred twice: Once, when about 1 cubic centimeter of solution was injected directly into an artery, there was immediate and violent occipital headache. This lasted about one hour. In another patient, who left the hospital right after his operation, there was dilatation of the pupil following injection of the second division. This may have happened in others of the series but escaped notice. Temporary paralysis of the eyelids may prove a little annoying, if too much fluid is deposited near the surface.

Pain and discomfort following the injection are rare. No patients have complained very much, and the average discomfort is less than that following the average peripheral injection. One might expect stiffness of the jaws, especially if much hemorrhage had occurred along the tract, but we do not believe this persistent stiffness has occurred in this series. One patient submitted to the injection willingly four times, one patient three times, and two patients on two occasions each.

Preliminary medication of morphine and atrophine or morphine and hyoscine was given in all but 11 instances.

Operations* were carried out as follows:

*Since this paper was sent for publication (January, 1931) 43 divisions have been injected in 27 more patients. In combination with deep block anesthesia of the cervical nerves four parotid tumors have been removed. The entire field is left free of local infiltration, and the annoying paralysis of the lower fibers of the seventh nerve that usually occurs from the local infiltration has been absent. Tracheotomy has been definitely avoided four times. The ganglion itself has been injected once and good anesthesia obtained for raising a large forehead and scalp flap.

Three radical for carcinoma of the antrum.

One simple for carcinoma of the face.

Four radical and two simple for carcinoma of the lip, including the switching of vermilion-bordered lip flaps.

Six radical and five simple for carcinoma of the buccal mucosa.

Eight radical for block glandular dissections (some of these classified also under carcinoma).

Three radical and four simple for benign tumors of the maxillas and mandibles.

Three open reductions and seven simple reductions with interdental wiring of fractures of the maxillas and mandibles.

One bone graft for nonunion of fracture of the jaw.

One double osteotomy for deformity of the mandibles.

Three drainages and osteotomies for osteomyelitis of the jaws.

One radical resection for ankylosis of the jaw.

Three osteotomies and plastic operations on face for secondary repair of extensive face injury.

Three extractions of teeth (impacted and infected).

One exploration for broken hypodermic needle.

Two plastic operations for secondary repair carcinoma of lip.

One hairlip.

One operation for removal of bullet from antrum.

Injections were done for:

One case of carcinoma for section of lingual nerve.

One case of carcinoma for localization of pain.

One case of tic douloureux for localization of pain.

One case of apparently plain hysteria in which no history could be secured until anesthesia was obtained.

One case of hysterical opening of the mouth, in which double dislocation had been diagnosed and bilateral open reduction proposed.

Additional regional anesthesia was used in 30 instances, including deep and superficial blocks of the cervical plexus, blocking the nasal nerves in the orbit at the anterior ethmoidal foramen; and peripheral blocks of other branches about the face.

ABSTRACTS OF
CURRENT LITERATURE

NUTRITION AND PEDIATRICS

By Samuel Adams Cohen, M.D., New York City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

The Malnutrition Factor in Rheumatoid Arthritis. F. D. Howitt and W. F. Christie. Lancet **221**: 5650, 1931.

Howitt and Christie writing from the British Red Cross Clinic for Rheumatic Diseases, London, state their clinical impressions concerning the malnutrition factor in rheumatoid arthritis. These authors are of the opinion that infection plays little or no rôle in the true cases of rheumatoid arthritis, and for this reason such unsuccessful therapeutic procedures as removing foci of infection—teeth, tonsils, and other foci are cited as clinical proof of nonexistence of infection as the causative factor of rheumatoid arthritis. According to these London observers and others, the disturbance to joints locally with the resulting vasoconstriction of blood vessels results from some endogenous factor and is in the main probably due to some disturbing influences such as the endocrine-sympathetic system.

The long history of definite prodromal symptoms—vague muscular pains, anorexia, fallen blood pressure, fatigue, loss of weight and the like—is referable to overstimulation of the katabolic group of endocrine glands. Accordingly the typical radiologic changes which show general osteoporosis loss of bone calcium are seen in such disturbances of metabolism which arise from hyperthyroidism and also from tumors of the parathyroid.

A close investigation of the diet of patients having rheumatoid arthritis did not show any marked qualitative fault which could account for their serious state of malnutrition. The observation of Pemberton, who found that in most of these cases there was a lowered glucose tolerance in the blood, was further elaborated upon by Howitt and Christie by a comparative study of the sugar contents made simultaneously in both the venous and the arterial capillaries. These investigators found that the muscles and tissues of rheumatoid arthritic patients are unable to deal with circulatory sugar in the normal way, either storage or oxidation being defective.

In view of these observations these authors felt that the administration of insulin would take care of these patients' abnormal hyperglycemia and also of the abnormal arterial-venous blood sugar difference. Their prompt and gratifying clinical results after injections of insulin into twenty patients with rheumatoid arthritis have convinced them of its value. About fifteen units of insulin were injected daily.

Howitt and Christie state, however, that in addition to the injection of insulin, additional food intake of 500 to 1000 calories in excess of the requirements of the body is necessary if weight is to be increased. These extra calories were usually given in the form of fat, that is, extra portions of cream, butter, cheese, animal fats and oils. Warmth, sunshine, rest, massage and physiotherapy are considered by them as valuable therapeutic aids in carrying out the treatment.

Although the patients were markedly improved as a result of this combined treatment, the authors mention the fact that the radiologic examination "has not so far revealed any return of calcium salts or other change as a result of treatment . . . . "

Relationship of Vitamin A to Respiratory Infections in Infants. L. H. Barenberg and J. M. Lewis. J. A. M. A. **98**: 3, 1932.

Barenberg and Lewis continue with the excellent work at the Home for Hebrew Infants, New York, in the efforts to reduce the incidence of respiratory infections. In previous reports investigators working at this Institution were unable to reduce the number of infections in infants who were given a series of exposures to the radiations of the mercury vapor quartz lamp. In 1926 the authors also reported that they found no significant relationship between the incidence of respiratory infection with infants who were similarly exposed to the carbon arc lamp.

The authors mention some of the extensive literature on careful animal experimentation which was conducted by outstanding authorities on nutrition. Many of these investigators found that animals receiving diets devoid of vitamin A invariably develop multiple infections to which they eventually succumb. Moreover, as an added proof, it was found that the administration of vitamin A to the diet brings about dramatic cure.

Because of the increasing interest and emphasis laid on the rôle of vitamin A in prevention of infection, Barenberg and Lewis undertook a worthwhile and timely study primarily to compare the incidence and severity of respiratory infection between infants receiving cod liver oil and those receiving viosterol. Their present study is purely clinical. Four groups of infants were studied, the first group receiving partly skimmed milk, second group receiving pasteurized milk and 20 drops of viosterol, the third group given pasteurized milk and 3 teaspoonfuls of standardized cod liver oil, and the fourth group receiving pasteurized milk and 6 teaspoonfuls of cod liver oil. These infants, whose ages range up to eighteen months, were observed in the Institution for a period varying from four to twelve months. In addition to the above, the infants were given the regular diet of the Institution. The results of their interesting experimentation may be, according to them, summed up in a few words: "No significant difference in incidence or severity of respiratory infections was noted in the four groups of infants. Thus the group which received the largest daily amount of vitamin A, through the addition of cod liver oil, was not protected against respiratory infections to a greater degree than were the other groups."

Results of Cardiac Examinations Among School Children. H. Sachs. Med. Klin. **27**: 37, 1931.

Sachs tells of his experience with his special clinic in Berlin for school children who have heart disease. He shares the opinion held by physicians in general who believe that as compared with adults children's hearts have greater powers of recuperation and compensation, and therefore should be given opportunity to adaptation.

Sachs rightly thinks that in general exercise is to be recommended for weak or neurotic children. Only in this way can these children and their constitutions be adjusted to take care of the many changes of pace, which require greater physical effort than the usual daily routine. Although it is not always practicable to ascertain, the author holds that the delay in recovery of alteration in pulse rate, and also of blood pressure, is the most exact estimation of effort effects in the circulation.

From the point of view of education and prophylaxis one of the functions of the clinics is the same which has already been put into practice in many cities in other countries. The reference is to establishment of cardiac schools in certain districts where such simple but important procedures as rest, exercise, stair climbings and other physical efforts are systematically carried out to the end that these children will learn how to take care of themselves.

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EDITORIALS

A Tribute Given at the Memorial Meeting to the Late Edward Hartley Angle

A MOST interesting and inspirational book has very recently come to my desk. On the front cover are inscribed the words "Edward Hartley Angle," and on the inside cover page there is a photograph of the late Dr. Angle, with the following inscription on the opposite page:

"A Memorial Meeting to the late Edward Hartley Angle held by the Eastern Association of Graduates of the Angle School of Orthodontia in the Vanderbilt Hotel, New York City, January 26, 1932.

"Within the pages of this book are the following subjects: 'Reminiscences of Walks and Talks with Dr. Angle'; 'The Introduction of the Angle System at the Ninth International Medical Congress'; 'The Teaching of Orthodontia as Dr.

Angle Viewed It'; 'Dr. Edward Hartley Angle: The Breadth of His Vision as a Specialist'; 'The Angle College of Orthodontia from the Student's Viewpoint'; 'My Friend, Edward Hartley Angle'; and 'Dr. Edward Hartley Angle.' ''

We quote excerpts only from the concluding paragraphs of the remarks of Professor Edmund Wuerpel of Washington University, St. Louis, who has been a close friend of the late Dr. Angle for many, many years. It would be interesting to orthodontists to print the entire work, but unfortunately space will not permit.

"There are not many. How can there be? None of us have the tremendous intelligence that he had. Very few of us have the endurance that he had. He gave himself.

"How fittingly he ended himself, how beautifully he ended himself! Dr. Osburn said that had he lived a year longer he would still have been busy with his researches. I am sure he would. Yet, he said these words, 'Anna, I am done. The work is done. I cannot do it any better.' Then he died; fine; beautiful!

"To how many of us is given to end in that way? I do not think his work was done. His work will never be done. It cannot be done. Here it is (waving his hand over the audience).

"It is in your hands. You can have his vision, partly; you can have his devotion, partly; you can have his ideal, partly. Into the great sum of all of your ideals and visions, all of his ideals and visions will be compressed. If you, as men, could give the thing that is best in you to this profession which he loved and which you love, if you could only for one hour a day recall to yourselves the term service, his end would be accomplished. I am sure of that; yours is too fine a field, too broad a field, too noble a field to be debased.

"Oh! There are many, so many, who are false, who use this fine and ideal profession as a means toward an end. But that is not your field, it cannot be. The more you can exert this influence at large among your followers, the higher and higher the standards of your personal and your professional ethics will be raised, until who knows but perhaps you may attain his standards. It can be done. What it needs is good-fellowship. What it needs is a leader.

"You have that leader. If you could only understand him, you would say, 'Yes, we will follow. Never mind whether we differed or not, it was a difference that meant nothing. We know that honesty, ethics, splendid craftsmanship, idealism are the things to work for.'

"Even though he is not with us in person he is always pointing the way. Shall we not follow? We are not often in contact with idealists and leaders; that sort of thing doesn't occur often. When it has been our privilege to have been led by such a prophet, why shall we not forget pettiness and misunderstanding, jealousy, and above all things, jealousy.

"He is gone, you cannot be jealous of him now. He is gone. You can use your intelligence. Use your idealism. Get from him the things that he stood for. Never mind the things that he didn't understand; and that you did not understand; forget them. The things you know, the things you honor and venerate, those you can always have. They are here. He gave them to you and they will never fade.

"If you follow those things, his goal will be reached. I am sure it is worth while. It is a fine profession. I couldn't be an orthodontist if I would, and I do not want to be, but the idealist that you should be, I am. In my profession it is just as sacred and just as profound as it is in yours. Do your best, not for yourself but for humanity. If you do that your goal will be reached."

It is doubtful whether, within the entire history of dentistry, there has lived a man who devoted his entire life so religiously to any department of dentistry as did Dr. Angle to the subject of orthodontia, which was so important to him.

To read this little booklet portraying and outlining the story of a man whose friends paint a word picture of his devotion to his work is an inspiration within itself. It is a matter of common knowledge that each and every man who ever came in contact with Dr. Angle, particularly in the relationship of teacher to student, was inspired by an indefinite, intangible something which though difficult to describe, nevertheless, was in the air, in the orthodontic atmosphere which constantly surrounded this man. There can be no question in that Dr. Angle has left an indelible imprint on the development of orthodontia. Not only has he left this mark upon the science, but he has left the same identification mark and stamp on many men of what might be called, for the want of a better term, inspiration and enthusiasm for the subject of orthodontia. Each and every man in the entire world who practices orthodontia either as a specialty or as a department of general practice, should read this book from cover to cover. Regardless of orthodontic creed, religion or previous condition of servitude, he will be a better orthodontist for having read it. Dr. Angle was sincere, he was honest, courageous and unquestionably had the courage of his convictions at all times.

The book, published by the Alumni Society of the Angle School of Orthodontists, is the true story, written by his friends, of a man who devoted his life, entire energy and ambition to an ideal, and it is to be hoped not in vain.

There were many who disagreed with his policies; others claimed that he was a man misunderstood, aside from his own small group of close sympathizers and followers. At times he must have been disheartened and sick as a result of opposition and ridicule from those who did not coincide with his views. Notwithstanding all of this, he was an inspiration and the father of the modern science of orthodontia. He has won the respect and admiration of all the orthodontic workers of the world. Whether his general viewpoint of the world's scheme of things scientific was right or whether it was wrong is now unimportant and an incident to modern orthodontic thought. The fact must remain that he left a great imprint on the orthodontic sands of time, which will never be erased in generations to come. He was an inspiration to both friend and foe alike, a most extraordinary man, and he practically launched orthodontia on its journey to recognition as a science.

It is to be hoped his ideals of efficiency, thoroughness, his artist's perspective and viewpoint of orthodontia will live on forever and that they will still be an inspiration to young men entering the profession. The possibilities of the corrections of deformities of the face in child life are much greater indeed for his having lived and worked. His original classification was, has been, and still is the foundation of scientific orthodontia.

Sunshine and Vitamin D

So much is said these days about the dearth of sunshine and its consequent inhibition to man's well-being, there is so much ballyhoo in regard to the various and sundry means of providing synthetic varieties of this precious life-giving something, that it is to be wondered whether or not this proposition of canned sunshine is not being overemphasized far beyond its intrinsic importance. We now have vitalized cigarettes, sun kissed everything, vitalized cows. The latest is vitalized feed to build up surcharged cows which, in turn, are purported to be able to give birth to and rear sun kissed calves, which in their turn, will leave these potent characteristics to their cow posterity of future generations. It is difficult even in one's most enthusiastic moods to believe without considerable reservation that all of these sundry products which are supposed to contain Vitamin D are universally important. However, the beneficent sun rays which really contain Vitamin D have been amply and conclusively proved by accredited scientists and investigators.

The *Journal of the American Medical Association* reports cases in infantile rickets in which the effects as gained during a season vary during the progress of the disease. Medical men have shown the antirachitic effect of sunshine in Toronto in April and May to be approximately eight times as potent as in December, January and February.

The writer, Day, has found in cases where patients exposed themselves to sunshine ten minutes each day over a period of forty days in mid-summer that rapid calcification resulted. Hess claims that in the tropics rickets occurs as a disease infrequently, and when it does occur, it is only in a very mild form, possibly in cases where the baby has been almost wholly confined indoors for many weeks. It is, however, a significant thing to know that it has been definitely found that the intensity of rickets throughout the world corresponds rather definitely to the amount of intensity of sunshine.

Accordingly, it has been found that the dominant factor in the antirachitic activity of the solar rays is not so much the number of hours of sunshine exposure as its quality and intensity. High altitude sunshine seems to be the ideal in intensity and potency as claimed by a number of writers upon the subject.

An expression by Lewis would indicate that the effective biologic rays of sunshine in June and July are quantitatively of more magnitude in a higher altitude than in a lower altitude. Some investigators say that the freedom of the atmosphere from moisture and smoke may offer a satisfactory explanation of the high altitude potency of sunshine. The observations on experimental animals are supported by a comparative record of rickets in a high altitude. Another interesting thing is the demonstration that there is no difference in the antirachitic effect of winter and summer sunshine in very high altitudes.

In any event, climatic variations have assumed new importance in so far as they are related to nutrition, particularly in childhood and adolescence. This interests orthodontists because light and the subtle Vitamin D play a highly important rôle in ossification of bone, but just how and why obviously are still "mysterious phenomena." The researches of Dr. McCollum have shown that nutrition plays a very important part in the ossification of bone and that the

absence of this normal factor brings about rickets. In turn, he has shown that light is important to nutrition and that the absence of light prevents the fixation of calcium and leads to rickets.

We know then that light is important in nutrition, that it does something, that it influences nutrition in a favorable manner. Perhaps the next ten years will give us more information.

Correspondence

Editor,
JOURNAL OF ORTHODONTIA, ORAL SURGERY, AND RADIOGRAPHY,
St. Louis, Mo.
Dear Sir:

Having been a constant reader of your Journal for a number of years, I have gathered much excellent information from its pages, and feel that my bound volumes contain a very liberal education in themselves. However, I have been attracted by the scarcity of material published on the subject of children's dentistry.

As orthodontists, we all realize the vital importance of child dentistry, and the close relationship of the two subjects. Our obligation does not stop with the proper correction of malocclusion, but we should extend our efforts by endeavoring actually to prevent it. If we are familiar with this work, we then can intelligently cooperate with the general practitioner and pedodontist and thereby help prevent much unnecessary dental repair and suffering.

After eleven years of general practice of dentistry, it is my observation that more than one-half of the dentistry being done today is a result of dental neglect during childhood. In other words, more than one-half of the extractions, crowns, bridges, inlays, dentures, and treatments, could be prevented if we, in our profession, would give adequate and proper care to children.

Much has been said and written on the subject of preventive dentistry. If there is such a thing as preventive dentistry, this practice certainly should begin with child dentistry. In fact, for the best results, preventive dentistry must begin with the proper education of the expectant mother before the child is born.

A patient with a wrecked mouth comes into the dental office for repair. Does the dentist try to decide just why that mouth is in such poor condition? Why there is so great a pathologic condition present? Why that patient has impaired health and will be forced to wear dentures at a comparatively young age?

In most cases the answer to the above questions would be, "lack of proper dental treatment and education before the patient was twelve years of age."

These conditions existing in children and adults are not due to lack of proper public education in regard to the care of children's teeth, but they are due to the lack of cooperation of the dentists themselves.

Too frequently the dentist shows a marked indifference and refuses to do anything for the child after the parent has done his part by bringing the child to the dental office. The dentist implies to the parent that the deciduous teeth will soon be lost and replaced by the permanent, and thus it is not necessary to care for them.

This attitude on the part of the dentist is due either to gross ignorance or to the fact that he is so concerned with his own personal inclinations that he is dishonest and not big enough to face the issue squarely.

If it is ignorance on the part of the dentist, he certainly can be educated and enlightened, provided he is willing and sufficiently open-minded to read and study the literature now available on the subject. Here, let me enter the plea that our dental schools and colleges give the subject of pedodontia the attention and place that it deserves.

If, on the other hand, the child is neglected because the dentist does not like children or does not care to work for them for economic and various reasons, he can at least inform the parents of the true facts and refer the little patient to a competent pedodontist who will give the child the proper dental care. In so doing, he is preventing untold suffering, deformities, and ill health, and is giving the child a much better chance to fill his place in life.

Until the present time, the attention of our profession has been devoted to work of restoring lost or destroyed dental structures, while the only real hope we have is in the early prevention of this loss. This means we must start while the child is young and make systematic and periodic examinations in order to prevent trouble; we must be sure that every slight defect is cared for each time the child visits the office.

When children are three years of age, they are not too young to start examinations and operative work, but the chief aim should be the minimum of operative work and the maximum of prevention. During this period the child should be taught and educated to form habits of oral hygiene.

Dr. Charles H. Mayo has said that 80 per cent of all diseases of children arise in the mouth, nose, or throat, and that 90 per cent of all deaths occur as a result of diseases having their origin in this area, or of the development in other parts of the body of diseases that have their origin in the nasal or oral cavities. These figures are startling, and in the face of them how can we, as members of the dental profession, continue to neglect the mouths of children as we have been doing?

In justice to children and to our profession, I feel that good articles and papers on the subject of juvenile or child dentistry in your Journal would be a great step forward.

Yours fraternally,
(Signed) RAY WOODWORTH
Topeka, Kansas

THE INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY will be glad to receive for consideration, original manuscripts pertaining to any phase or department of children's dentistry. Dentists are interested, particularly, in children's dentistry because this means prevention, nutrition, and the broad perspective of the entire phase of dentistry as it pertains to general health problems.

EDITOR.

NEWS AND NOTES

The American Society of Orthodontists
Thirty-First Annual Meeting

The annual meeting of the American Society of Orthodontists will be held in Toronto, Canada, May 18, 19, and 20 at the Royal York Hotel.

Plans for the convention are being carried forward, and the following is a list of the committees.

General Arrangements:
Dr. G. V. Fisk
Dr. S. S. Crouch
Dr. C. A. Kennedy

Banquet Committee:
Dr. H. B. Bean
Dr. C. A. Corrigan

Registration Committee:
Dr. W. R. Hendry
Dr. J. A. Priestman

Recreation Committee:
Dr. G. W. Grieve
Dr. A. A. Somerville

Exhibits Committee:
Dr. H. C. Bliss
Dr. W. J. Hill

Entertainment is being planned for the ladies who attend the convention.

Come to Toronto for the Convention

Our next convention city—Toronto, Canada—has the unusual distinction of being a great manufacturing city, a city in which centers one of the most important financial developments of Canada, and still is a great summer resort. If cities, like people, are more interesting at certain stages of their careers than at others, it is doubtful whether Toronto will ever present a more intriguing picture than it does today.

As a shipping point, Toronto is important, situated in the center of the most densely populated area of Canada, and the focal point of the world's two largest railways—the Canadian Pacific and the Canadian National Railways. In Toronto mercantile and industrial financing have produced a beehive of industry with products going to all parts of the world. Labor conditions are of the best and Toronto has the cheapest electric power in the world.

Toronto has 2,350 industrial plants of various sizes, in which are employed 109,000 men and women. The wide diversification of these industries makes for industrial and economic stabilization and also creates an ideal employment situation which is of great value to the industries already established, to new industrial concerns considering this city as a place to locate, and to commercial activities of the community. The fact that there is a continuous program of plant enlargement and expansion among the industries already located in this city, is an evidence of Toronto's stability and advantages from an industrial standpoint. Toronto is the Canadian home of more than 300 United States industries.

Canada today is the most prosperous country in the world, and Toronto, with its 850,000 people, is Canada's most important manufacturing city. It is the automobile center of Canada and the wholesale jobbing center of the Province. The National Foreign Trade Council of New York recently issued a statement showing that Canada had led all nations in increased trade since 1913. The Dominion headed the list with an increase of 105 per cent, followed by

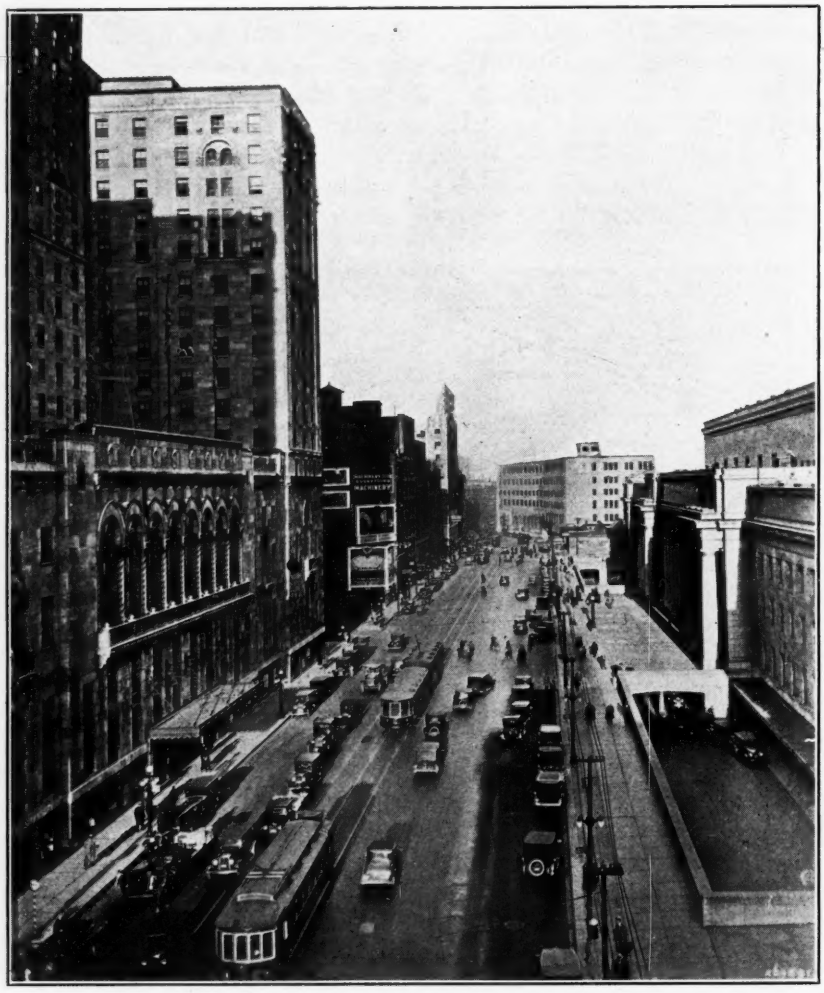
Australia with 69 per cent, and the U. S. A. with 57 per cent. The League of Nations Bureau recently issued the statement that Canada's per capita wealth had grown from $1,100.00 in 1903 to $2,406.00 in 1926. No nation has previously shown such a rapid growth. The National Bureau of Research of the United States recently published the results of seventeen years' trading, showing that Canada had enjoyed more prosperity than any other nation.

Great skyscrapers may be seen all about the downtown district, and nearby delving steam-shovels and clanging riveters foretell the story of Toronto's future as a great metropolis. Toronto has definitely stepped into the metropolitan stage in its entertainment and

The Royal York Hotel which will be the headquarters for the convention.

amusement facilities. The city is the gateway to the great Northern Ontario gold fields with their vast mineral wealth, and is the clearing center of this huge new business. Toronto has the largest mining exchange in the world. Always a city with a distinctive atmosphere and flavor of its own, Toronto has assumed for this Continent a position similar to that of Geneva, Switzerland, or Edinburgh, Scotland, on the other side of the Atlantic. It is one of the places that must be visited to be appreciated.

In the spring, summer and early fall, Toronto takes on the atmosphere of a huge summer resort—miles and miles of beautiful beaches, every kind of summer amusement, including twenty-six golf links. Driving into Toronto you find at its entrance one of the most elaborate waterfront boulevard developments in the world. In a few minutes you are at Sunnyside—one of the finest and most complete amusement parks to be found anywhere. Here, every kind

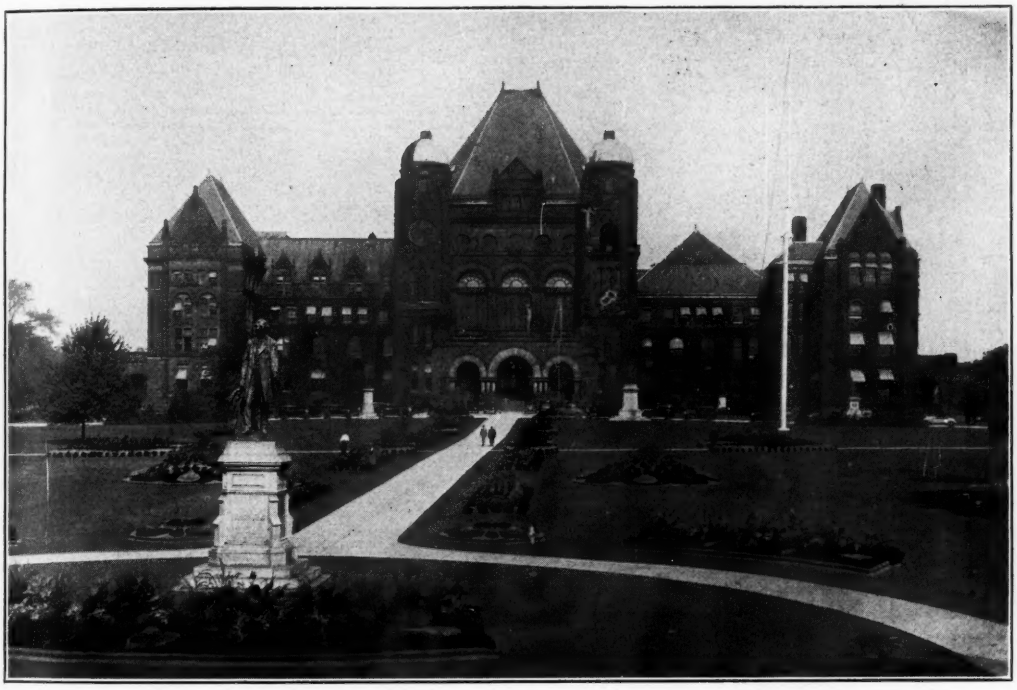


Front Street in the metropolitan district of Toronto.

University of Toronto.

of resort amusement, beautiful bathing beaches, and the world's largest heated swimming pool are located. Plenty of interesting places to dine and dance, open-air theaters, all the newest games and rides, sea-flea races, motor-boat races, whippet races, softball, horseback, canoeing, sailing, and bathing are provided. The boardwalk is never without its throng of visitors. Aquatic Clubs dot the shore all the way, even into the heart of the city. The boardwalk starts at the entrance of the city, runs thence along two and one-half miles of lakefront, terminating at the Canadian National Exhibition Grounds.

Toronto is justly proud of her educational system. The University of Toronto ranks among the first of educational institutions of the world, and with its affiliated colleges, is the largest on the continent. It was at this university that insulin was discovered by Dr. F. A. Banting. Close to the University will be found the Parliament buildings, in a beautiful floral setting. Here all the legislation for Ontario is enacted. Close to this is the Royal Ontario



Parliament buildings, Toronto.

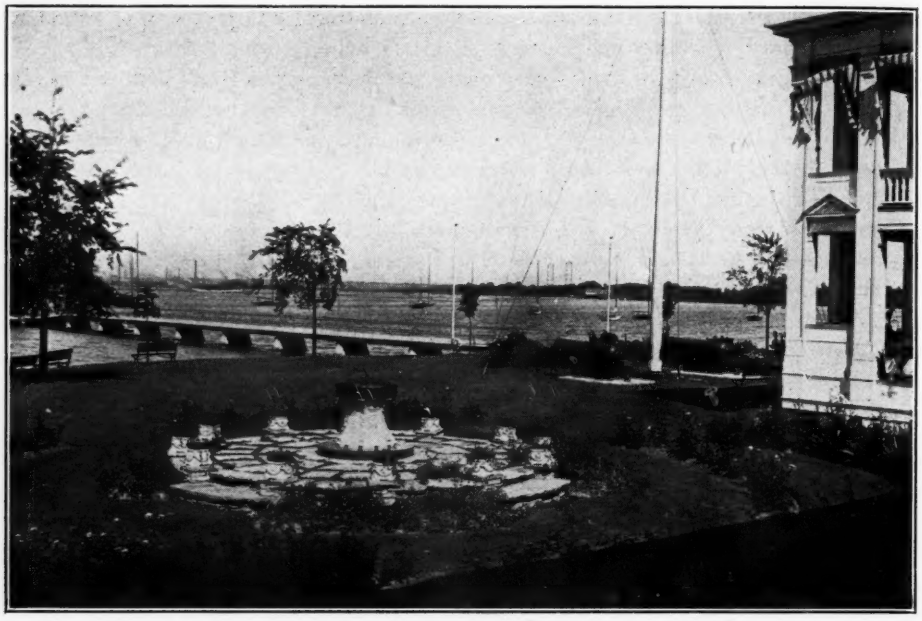
Museum which has one of the finest Chinese collections, in addition to other interesting and educational exhibits from all parts of the world.

The Toronto General Hospital, which takes its place among the best on any continent, is the pride of Torontonians, with the Hospital for Sick Children adjoining.

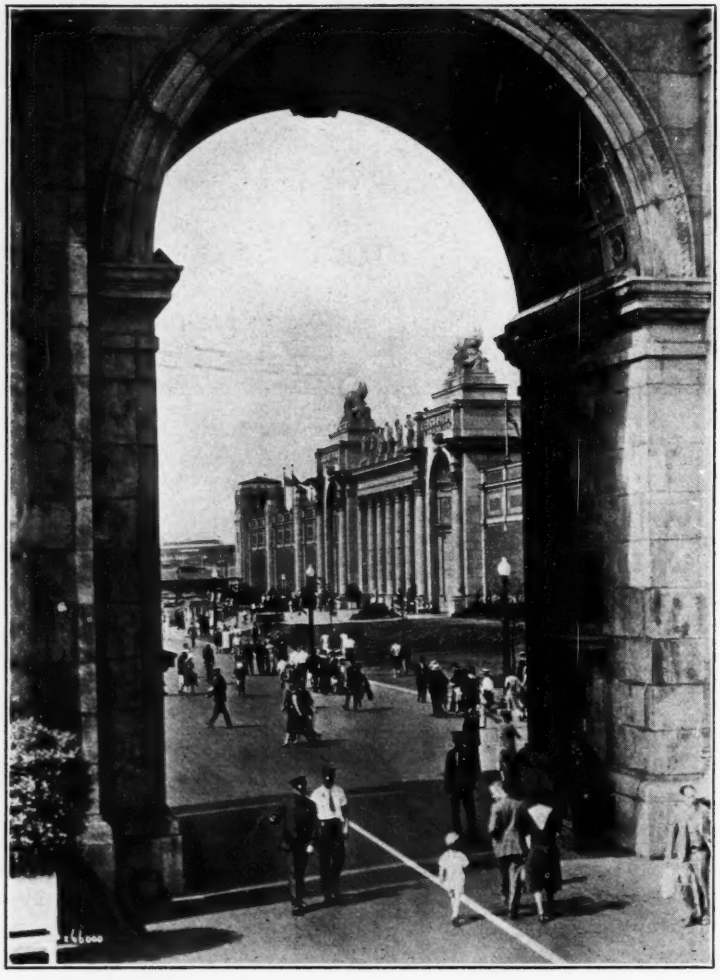
The birthplace of Mary Pickford is located at 211 University Avenue. This home is visited by thousands of tourists annually.

By all means, visitors should not fail to see Toronto's beautiful islands, which lie one mile south of the city and are served by ferries, and particularly Centre Island and Hanlan's Point. It takes ten minutes by ferry, and one would think on arriving there that one was a hundred miles away from the city. The scenery is delightful and these islands are the largest public playgrounds in the world. Many of the élite of Toronto have their summer homes on these attractive islands.

The Gray Coach Lines operate motor launches at convenient intervals, making a delightful trip around the islands and through the beautiful lagoons. The trip takes one hour. The launches hold twenty-nine people and leave from the ferry docks at the foot of Bay Street. The Royal Canadian Yacht Club is located on these islands and is the largest fresh water yacht club in the world.



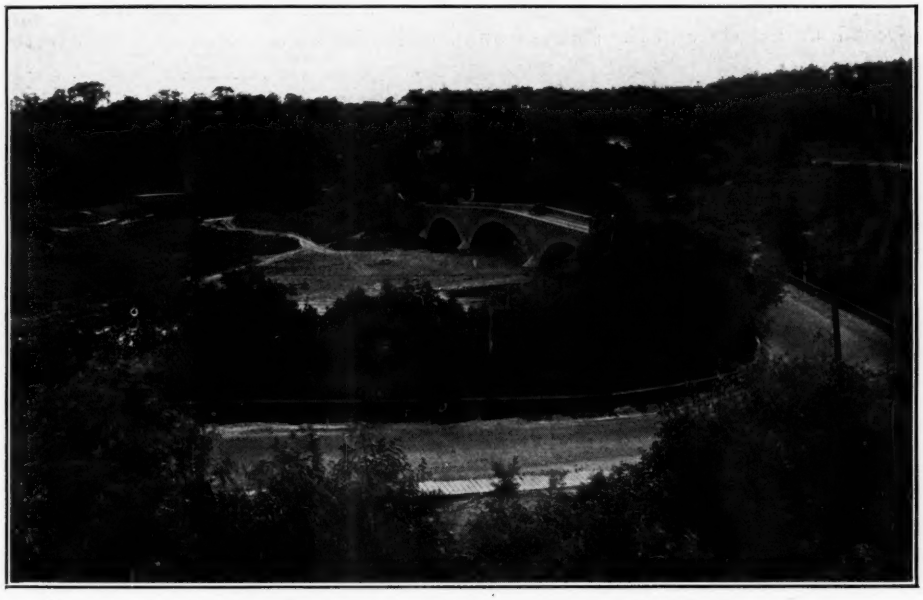
The Royal Canadian Yacht Club, Centre Island.



Prince's Gate at the Canadian National Exhibition Park.

Churches of every denomination are evidenced all about the city. The Metropolitan United Church which occupies a city square, has in its tower one of the three largest set of carillon chimes on the North American continent. During the season, there are frequent recitals. St. Michael's Roman Catholic Church is a fine example of Gothic architecture; it was built in 1859. St. Andrew's Presbyterian Church is considered one of the finest examples of Norman architecture in America. Old Trinity Church in Toronto's oldest section is a place of great interest to visitors. Other popular churches are the First Church of Christ—Scientist, Timothy Eaton Memorial Church, St. Paul's Anglican Church, and St. James' Cathedral.

The Canadian National Exhibition Park, which houses the world's largest exhibition during the last week in August and the first week in September, with an annual attendance of over two million people, covers an area of 350 acres, with a mile and a half of lakefront, and has more than one hundred permanent buildings, representing a twenty million dollar expenditure. Visitors should make it a point to see these beautiful grounds and buildings, located ten minutes from downtown Toronto.



Humber Valley Bridge at the Old Mill.

Other places of interest are Casa Loma—the Continent's most sumptuous home, costing into millions of dollars; the Toronto Public Library; the Toronto Art Gallery; the Armouries; Riverdale Zoo; Hart House; Toronto Conservatory of Music; and the magnificent City Hall which is visited annually by thousands who see Toronto from its tower. Toronto also boasts of the finest of theaters and the very best of attractions. The Maple Leaf Baseball Stadium is one of the finest in America and is the Toronto home of the International League.

From Toronto there are many one-day side trips; by boat to Niagara Falls, Queenston, Niagara-on-the-Lake, and Port Dalhousie; by motor coach to Niagara Falls, Lake Simcoe and the Trent Waterway. The network of paved roads makes fine motoring for day trips out of Toronto. In Toronto every convenience which will add to the comfort of tourist and convention delegates in any way is to be had in goodly variety. No money has been spared in making the streets of Toronto second to none, nor are the parking limits as exacting as in other cities of even less population. Add to all this the comfort of warm days and cool nights (nights sufficiently cool for sleeping, even at the peak of the summer). Always, there awaits you that which is Toronto's most valuable asset—the unfailing courtesy and hospitality of her citizens. A note addressed to the Toronto Convention and Tourist Association, Executive Offices at Hotel Waverly, Toronto, Canada, will bring to you an illustrated folder on Toronto which gives interesting information regarding the city, customs regulations on motor cars coming into Canada, and good roads.

The American Board of Orthodontia

A meeting of the American Board of Orthodontia will be held at the Royal York Hotel, Toronto, Ontario, on May 16 and 17, 1932.

Those orthodontists who desire to qualify for a certificate from the Board should secure the necessary application form from the Secretary. The application must be returned to the Secretary, together with any other required credentials, at least sixty days prior to date of examination. In order to expedite the examinations the Secretary will designate the hour at which the applicant may appear before the Board on one of the above mentioned days. Applications filed at the time of Board meeting will have preliminary consideration, so that applicant may be advised of work required for his subsequent examination.

Attention is called to the following resolutions adopted by the Board:

Any person desiring to make application to the Board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the Board and based upon the following conditions:

First, an instructor in Orthodontia in a school satisfactory to the Board.

Second, an associate in the office of an orthodontist whose standing is satisfactory to the Board.

It is, however, definitely to be understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

ALBERT H. KETCHAM, President,
1232 Republic Building,
Denver, Colo.
OREN A. OLIVER, Secretary,
1101 Medical Arts Building,
Nashville, Tenn.

Pacific Coast Society of Orthodontists

The Fifteenth General Meeting of the Pacific Coast Society of Orthodontists will be held at the Palace Hotel, San Francisco, Calif., February 18 to 20, 1932.

Program

THURSDAY, FEBRUARY 18, 1932

8:00 A.M. Registration.

9:15 A.M. Meeting called to order.
Welcome.
Introduction of visiting orthodontists.
Charge of new members. By Vice President Dr. W. J. Lea, Vancouver, B. C.
President's Address. By Dr. Harvey A. Stryker, Santa Ana, Calif.

10:00 A.M. Eight Years' Observation of Growth Changes in the Dental Arches. By Dr. Samuel J. Lewis, Detroit, Mich.
Discussion opened by Dr. Albert H. Ketcham, Denver, Colo.

11:15 A.M. Mechanical Therapy in Orthodontia in Its Relation to Growth and Development of the Dental Arches. By Dr. Herbert A. Pullen, Buffalo, N. Y.

12:15 P.M. Luncheon.

1:30 P.M. Case Report—Mandibular Displacement. By Dr. Percy Norman Williams, Tucson, Ariz.

2:00 P.M. Ethics and Business Practice in Orthodontia. By Dr. B. Frank Gray, San Francisco, Calif.
Discussion opened by Dr. James D. McCoy, Los Angeles, Calif.

3:15 P.M. Nutritional Influences on Growth and Development. By Dr. Harold F. Hawkins, Los Angeles, Calif.
Discussion opened by Dr. John A. Marshall, San Francisco, Calif.

4:30 P.M. Case Report—Closed Bite Cases. By Dr. Harry L. Morehouse, Spokane, Wash.

FRIDAY, FEBRUARY 19, 1932.

9:00 A.M. Molar Adjustments Incident to Dental Arch Growth. By Dr. Samuel J. Lewis, Detroit, Mich.

10:00 A.M. The Spring Loop Mechanism Embodied in Labial or Lingual Arches or as an Independent Appliance for Correcting Malocclusion. By Dr. Herbert A. Pullen, Buffalo, N. Y.

Discussion opened by Dr. Allen E. Scott, San Francisco, Calif.

11:15 A.M. Motion Picture—Denture and Facial Reproductions. By Dr. James D. McCoy and Dr. John R. McCoy, Los Angeles, Calif.

12:15 P.M. Luncheon.

1:30 P.M. Deficient Diets and Experimental Malocclusion Considered From the Clinical Aspect. By Dr. John A. Marshall, San Francisco, Calif.

Discussion opened by Dr. Albert H. Ketcham, Denver, Colo.

2:30 P.M. An Appraisal of 500 Series of Roentgenograms, With Reference to the Resorption of the Deciduous Roots, and the Formation and Eruption of the Permanent Teeth. By Dr. Samuel J. Lewis, Detroit, Mich.

Discussion opened by Dr. Robert Dunn, San Francisco, Calif.

3:30 P.M. Fundamental Principles of Clinical Photography. By Dr. Frederick Schubert, San Francisco, Calif.

Discussion opened by Dr. B. E. Lischer, San Francisco, Calif.

4:30 P.M. Case Report—Mandibular Retraction Complicated in the Maxillary Arch by Impaction of the Canine and Resorption of the Central Incisor. By Dr. Allen E. Scott, San Francisco, Calif.

7:00 P.M. Banquet.

SATURDAY, FEBRUARY 20, 1932

9:00 A.M. The Adaptation of Correctly Formed and Efficient Instruments in the Field of Operative Technic. By Dr. Herbert A. Pullen, Buffalo, N. Y.

Discussion opened by Dr. Harry L. Morehouse, Spokane, Wash.

10:15 A.M. On the Relation of the Human Denture. By Dr. F. H. Orton, San Francisco, Calif., and Dr. B. E. Lischer, San Francisco, Calif.

11:30 A.M. Motion Picture—Physiology of Mastication. By Dr. Hugh W. MacMillan, Cincinnati, Ohio.

11:45 A.M. Business Meeting.

12:30 P.M. Luncheon.

2:00 P.M. General Clinics and Exhibits.

1. Anatomically Contoured Seamless Anchor Bands and Exhibit of Instruments. By Dr. Herbert A. Pullen, Buffalo, N. Y.
2. Exhibition of Series of Models Showing Growth and Developmental Changes. By Dr. Samuel J. Lewis, Detroit, Mich.
3. A Roentgenographic and Histopathologic Study of Changes Produced Experimentally in Teeth and Adjacent Bone of *Macours rhesus*. By Dr. John A. Marshall, San Francisco, Calif.
4. Demonstration of New Photostatic Camera. By Dr. Frederick Schubert, San Francisco, Calif.
5. Demonstrating Instruments to Determine Relation to Skull of (A) Maxillary Arch, (B) Mandibular Arch, (C) Mandible. By Dr. Percy Norman Williams, Tucson, Ariz.
6. Molar Band Construction, Indirect Method. By Dr. W. J. Armstrong, Los Angeles, Calif.
7. Methods for Polishing Plaster Models. By Dr. A. J. Gray, Los Angeles, Calif.
8. Bite Plane in Conjunction With Hawley Appliance. By Dr. B. L. Reese, Los Angeles, Calif.
9. Appliance Technic. By Dr. Walter J. Furie, Long Beach, Calif.

10. A Variation in Anterior Band Construction, and Ketcham Hook Technic. By Dr. Hays N. Nance, Los Angeles, Calif.
11. Stereoscopic Photography. By Dr. Earl Lussier, San Francisco, Calif.
12. Patient Showing Orthodontic and Prosthetic Restorative Work. By Dr. Forrest H. Orton, San Francisco, Calif.
13. Use of Hawley Appliances in Correction and Retention of Distoclusion Cases. By Dr. W. R. Dinham, Seattle, Wash.
14. Demonstrating an Appliance to Assist in Treatment of Open-Bite Cases. By Dr. Paul Lewis, Seattle, Wash.

(This list of clinics is incomplete, but will be given in full in the regular program.)

The following committees are arranging the meeting:

Program Committee:
Dr. Frank M. Taylor, Chairman
Dr. Fred Wolfsohn
Dr. Geo. A. Barker

Clinic and Case Reports:
Dr. Allen E. Scott, Chairman
Dr. Hays N. Nance, Southern Section
Dr. Paul D. Lewis, Northern Section

Banquet:
Dr. B. Frank Gray, Chairman

General Arrangements:
Dr. Fred Wolfsohn, Chairman
Dr. Allen E. Scott
Dr. F. A. Leslie

Entertainment Committee:
Dr. Fred Wolfsohn, Chairman
Dr. Carl N. Dorman
Dr. Thomas R. Sweet

The Sixty-First Annual Meeting of the Kansas State Dental Association

The Sixty-First Meeting of the Kansas State Dental Association will be held at the Allis Hotel, Wichita, Kansas, April 25, 26, and 27, 1932. Among the speakers will be Dr. Adolf Berger, New York City; Dr. Sterling V. Mead, Washington, D. C.; Dr. Herbert D. Coy, Hamburg, Iowa. All members of the A. D. A. are cordially invited to attend.

FRED A. RICHMOND, Secretary,
305 Federal Reserve Building,
Kansas City, Kansas.

American Dental Assistants Association

The Eighth Annual Meeting of the American Dental Assistants Association will be held in Buffalo, New York, September 12 to 15, 1932. For further information address

RUTH M. CLARK, General Secretary,
Suite 1-4, Scofield Building,
Minot, North Dakota.

Southwestern Society of Orthodontists

The Twelfth Annual Meeting of the Southwestern Society of Orthodontists was held January 25, 26, 27, 1932, at the Herring Hotel, Amarillo, Texas.

The following papers were presented at this meeting: President's Address by Dr. Wm. B. Stevenson; "Ethics and Economics" by Dr. Martin Dewey; "The Influence of Pressure on Osseous Development and Function" by Dr. John T. Gray; "Diagnosis With Special Reference to Cephalic Methods" by Dr. Martin Dewey; "The Physics of Orthodontia Materials" by Dr. Martin Dewey; "Some Observations on Diagnosis and Mystic Prognosis Gained From Failures in Practice" by Dr. Paul G. Spencer.

The table clinics given were: "Some Time Savers" by Dr. Homer B. Robison; "A Board With Several Appliances Showing the Various Uses of the Coil Spring" by Dr. E. B.

Arnold; "Opening Up Spaces for Mandibular Right and Left Impacted Second Premolars Using the Arnold Coil Spring" by Dr. J. S. Cunningham; "Ribbon Arch Appliance Construction" by Dr. E. E. Moore; "Useful Accessories in the Simplification of Orthodontic Practice" by Dr. P. J. Murphey; "A Method of Soldering Half-Round Wire to Base Wire" by Dr. Curtis Williams; "Various Types of Auxiliary Springs" by Dr. William E. Flesher.

The case reports were as follows: "Early Development and Nutritional Disturbance Showing in Deciduous and Permanent Teeth" by Dr. T. M. Robertson; "Case Report Showing Both Maxillary Central Incisors on the Same Side of the Median Line" by Dr. A. B. Conly; "Open-Bite Case" by Dr. J. H. Weaver; and Case Reports by Dr. T. G. Duckworth, Dr. T. Wallace Sorrels, and Dr. Walter E. Lipscomb.

Psi Omega to Celebrate Fortieth Anniversary

In commemoration of the fortieth anniversary of the founding of Psi Omega Dental Fraternity in Baltimore, during the winter of 1892, Oriole Alumni Chapter and Phi-Alpha Active Chapter will hold an anniversary celebration at the Lord Baltimore Hotel, on Saturday, April 16, 1932.

All Psi Omegas are invited to attend. The banquet charge will be five dollars per cover, and reservations can be made through

ALEXANDER H. PATERSON, General Chairman,
Medical Arts Building,
Baltimore, Md.

The Dental Hygienists Association of the State of New York

The Dental Hygienists Association of the State of New York will hold its twelfth annual meeting, May 11 to 13, 1932, at the Centennial Hall, Albany, N. Y.

A cordial invitation is extended to all members of the dental profession, dental hygienists, and dental assistants.

BLANCHE A. DOYLE, President,
100 West 59th Street,
New York, N. Y.

Virginia—West Virginia Joint Meeting

The next annual meeting of the Virginia State Dental Association and the West Virginia State Dental Society will be held jointly at Winchester, Va., May 16, 17, 18, 1932.

Preliminary plans are well under way, and one of the largest and most interesting meetings ever held in the South Atlantic Section is predicted by the officers. Members of the American Dental Association are cordially invited to attend.

DR. R. B. SNAPP, General Chairman,
Winchester, Va.

The Dental Society of the State of New York

The Dental Society of the State of New York will hold its sixty-fourth annual meeting May 11, 12, 13, 1932, at Hotel Ten Eyck, Albany, New York. A cordial invitation is extended to all members of state societies, Canadian societies and ethical dentists.

The officers and committees will present a program which we trust will enlist the attention of all dental practitioners.

Dr. E. J. Burkhart, 800 East Main Street, Rochester, N. Y., is Chairman of the Program Committee; Dr. E. W. Briggs, 1116 Madison Avenue, Albany, N. Y., Chairman of the

Exhibits Committee; and Dr. E. Burley, 80 Fourth Street, Troy, N. Y., Chairman of the Clinics Committee.

For further information address the Secretary.

Dr. A. P. Burkhart, Secretary,
57 E. Genesee St.,
Albany, N. Y.

Notes of Interest

Dr. Ira Burton Stilson announces as an associate Dr. William Franklin Harrison, 234 Thayer Street, Providence, R. I. Practice limited to orthodontia.

Dr. H. H. Braxtan announces the removal of his offices to the tenth floor of The Professional Building, Central Avenue at Monroe, Phoenix, Arizona.